RECORD OF DECISION

Summary of the Final Remedial Alternative Selection for the Soil

and

An Interim Remedial Alternative Selection for the Groundwater

at the

Landia Chemical Company Site
Lakeland, Polk County, Florida

Prepared by the
United States Environmental Protection Agency

RECORD OF DECISION

Declaration

Site Name and Location

Landia Chemical Company (FLD042110841)

Lakeland, Polk County, Florida

Operable Unit One (Soil) - Final Action

Operable Unit Two (Groundwater) – Interim Action

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Landia Chemical Company Site (the "Site") in Lakeland, Florida, which was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record file for this Site.

The State of Florida, as represented by the Florida Department of Environmental Protection (FDEP), has been the support agency during the remedial investigation/feasibility study process for the Site. In accordance with 40 Code of Federal Regulation (CFR) Sec 300.430, as the support agency, FDEP has provided input during the process.

Assessment of Site

The response action selected in this Record of Decision is necessary to protect human health and the environment from actual or threatened releases of hazardous substances, pollutants or contaminants into the environment.

Description of Selected Remedy

This remedy includes the final action to addresses potential human exposure to contaminants in the soil (Operable Unit One - OU1) associated with the Site and an interim action to treat the most contaminated groundwater. After implementation and evaluation of the effectiveness of the interim action on reducing groundwater contaminant concentrations, a final action to address potential human exposure to contaminants in the groundwater (Operable Unit Two - OU2) will be selected to reach the ultimate goal of restoring the aquifer to drinking water standards. Most principal threat wastes that were originally present at the Site were removed during the previous removal actions. A small amount of principal threat wastes remain in the subsurface soil just above the water table. If not addressed, these remaining principal threat wastes would likely migrate into the groundwater at levels well above drinking water standards and significantly increase the amount of time needed to achieve cleanup standards. The remaining principal threat wastes will be addressed through excavation.

The major components of the remedy include:

- Excavation and off-site disposal of contaminated soil, a limited amount of which constitutes principal threats for unacceptable exposure to, and/or migration of, chemicals of concern (COCs);
- An interim action to treat the areas of groundwater which have been most impacted by site-related contaminants. This interim action shall consist of in-situ chemical oxidation treatment in pesticide source areas to address the highest groundwater contaminant concentrations and in-situ bioremediation in other selected areas to enhance the natural attenuation process. This interim action shall be implemented within a boundary established in the ROD which consists of areas north of Olive Street and shall be further refined during the remedial design phase. A performance monitoring plan shall be developed to evaluate the effectiveness of the soil remedy and the groundwater interim action on groundwater contaminant concentrations; and
- Institutional Controls to prevent exposure to contaminants including groundwater use restrictions, restrictive covenants added to deeds for the Florida Favorite Fertilizer (FFF) and Landia properties, and engineering controls to prevent exposure to soil contaminants.

Statutory Determinations

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost effective, and utilizes permanent solutions to the maximum extent practicable.

The remedy for soil (OU1) does not satisfy the statutory preference for treatment as a principal element of the remedy. Treatment of COCs is not part of the selected remedy because the soil to be remediated has relatively low contaminant levels. Most principal threat wastes were removed during the previous removal actions and only isolated areas of principal threat wastes remain. Due to the relatively small volumes of principal threat wastes remaining, the remedial technologies considered were consistent with the removal actions and included excavation and off-site disposal. The interim remedy for groundwater (OU2) satisfies the preference for treatment. The remedy will include a treatment process using chemical oxidation in areas with elevated levels of pesticide groundwater contamination and in-situ bioremediation in other areas of the treatment zone, reducing the toxicity, mobility and volume of COCs. Any excavated soil and sediment with characteristics requiring it to be classified as a RCRA hazardous waste will be treated pursuant to RCRA requirements (40 CFR 268) prior to disposal in an offsite Subtitle D landfill.

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, and will continue to be, protective of human health and the environment.

ROD Data Certification Checklist

The following information is included in the Decision Summary, Part 2, of this Record of Decision. Additional information can be found in the Administrative Record file for this Site.

- Chemicals of Concern (COCs) and their respective concentrations.
- Baseline risk represented by the COCs.
- Cleanup levels established for COCs and the basis for these levels.
- How source materials constituting principal threats are addressed.
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and the ROD.
- Potential land and groundwater use that will be available at the Site as a result of the Selected Remedy.
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected.
- Key factors that led to selecting the remedy.

Authorizing Signature

for

Franklin E. Hill, Director
Superfund Division

9/22/02
Date

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LIST OF ACRONYMS and ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Regulations
ATV	Alternate Toxicity Value
BDL	Below the laboratory Detection Limit
BHHRA	Baseline Human Health Risk Assessment
bls	Below land surface
bgs	Below ground surface
CAR	Corrective Action Report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COC	Contaminant (or Chemical) of Concern
COPC	Contaminant of Potential Concern
COPEC	Contaminant of Potential Ecological Concern
CSF	Carcinogenic Slope Factor
cys	cubic yards (also see yd^3)
DQO	Data Quality Objectives
EPA	United States Environmental Protection Agency
EPA-OTS	EPA Region 4 Office of Technical Services
EPS	Exposure Pathway Scenarios
ERA	Ecological Risk Assessment
EPC	Exposure Point Concentration
ESD	Explanation of Significant Differences
ESI	Expanded Site Inspection
ESV	Ecological screening values
FDEP	Florida Department of Environmental Protection
HEAST	Health Effects Assessment Summary Tables

HI	Hazard Index
HQ	Hazard Quotient
GCTL	Florida Groundwater Cleanup Target Level
IRIS	Integrated Risk Information System
LOAEL	Lowest Observed Adverse Effects Level
MCL	Maximum Contaminant Level
MEP	Maximum Extent Practicable
mg/kg	milligrams per kilogram or parts per million (ppm)
NCEA	National Center for Environmental Assessment
NCP	National Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No Observed Adverse Effects Level
NPL	National Priority List
OU1	Operable Unit 1
O&M	Operation and Maintenance
PA	Preliminary Assessment
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PCOPEC	Preliminary Contaminant of Potential Ecological Concern
ppb	parts per billion
PRP	Potentially Responsible Party
ppm	parts per million
PRG	EPA Region 9 Preliminary Remediation Goals
RAO	Remedial Action Objectives
RBC	EPA Region 3 Risk Based Concentrations
RBCA	Risk Based Corrective Action

RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
RG	Remedial Goals (i.e., cleanup levels)
ROD	Record of Decision
RPM	Remedial Project Manager
SARA	Superfund Amendments and Reauthorization Act of 1986
SAS	Superfund Alternative Site
SCTL	Florida Soil Cleanup Target Level
SDWA	Safe Drinking Water Act
SESD	EPA Region 4 Science and Ecosystem Support Division
SI	Site Inspection
SQL	Sample Quantification Limit
SVOCs	Semi-Volatile Organic Compounds
TAL	Target Analyte List
TAT	Technical Assistance Team
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxicity Equivalence Quotient
ug/kg	micrograms per kilogram
ug/L	micrograms per Liter
US	United States
US FWS	United States Fish and Wildlife Service
VOCs	Volatile Organic Compounds
yd^3	cubic yards
XRF	X-ray fluorescence
<	less than

Part 2: THE DECISION SUMMARY

1.0 Site Location and Description

The Landia Chemical Company Site (the Site) is located at 1405 Olive Street in Lakeland, Polk County, Florida (Figure 1). The EPA Site Identification Number is FLD042110841. Pesticide blending and formulating operations were conducted on the Landia property from 1945 until 1987 by three different companies (Standard Spray and Chemical (1945-1976), Agrico Chemical Company (1976–1977) and Landia Chemical Company (1977-1987). These operations resulted in the release of various pesticides, metals and volatile organic compounds (VOCs) into the environment. The Landia property is currently used by an unrelated entity for the storage of construction forms. Access to the Landia property is restricted by chain-link fencing and locked gates.

Also being addressed as part of the Site are contaminants on the property located just west of the Landia property at 1607 Olive Street. Historical operations at the Landia facility included the use of portions of the property, formerly owned by Florida Favorite Fertilizer (FFF), for the storage of bulk sulfur. Storage of this sulfur increased the acidity of the groundwater which likely enhanced the mobility of the pesticides and metals in the groundwater. FFF conducted fertilizer blending operations on the FFF property from the mid 1930's until the property was sold in 2006. The current owner conducts operations similar to those conducted by FFF. Only bulked fertilizer products (potassium, nitrogen and phosphorous) are blended or stored at the FFF property. However, operations at this facility have resulted in the release of various nutrients particularly nitrates which are present in the groundwater above health based standards and are co-mingled with pesticide contamination from the Landia property. Access to the FFF property is restricted by chain-link fencing and locked gates.

The Site is primarily surrounded by industrial and commercial properties as shown in Figure 2. The closest area of residential properties is located just south of the Site on the south side of Olive Street. West of the Site are the Tifton and the Arapahoe Triangle properties (industrial). Pesticide manufacturing has been documented to have occurred on the Tifton property where EPA conducted a removal action in 2004. Immediately to the east of the Landia property is a commercial/light industrial property which fronts Olive Street. Olive Street borders the Site on the south. Land immediately south of the Landia property is owned by the Onesiphorus Gospel of Christ church and a car repair business. North of the Site, running east-west is an active railroad corridor. To the north of the rail road right-of-way are several commercial/light industrial properties that front George Jenkins Boulevard. These properties include the Lakeland Industrial Park, Southern Milling & Lumber Company, Lineberger Fuel Company, and the YMCA Golf Course.

Since 1999, EPA has been the lead agency in charge of ensuring the contamination at the site is addressed through the Superfund program to be protective of human health and the environment. The Florida Department of Environmental Protection (FDEP) is the support agency representing the interests of the State of Florida. The investigation and cleanup of the Site has been funded by the Potentially Responsible Parties (PRPs), Agrico and Florida Favorite Fertilizer (owned by PCS Joint Ventures, Inc.(PCS JV)). Additional PRPs may be named in the future. In February 2000 EPA proposed the Site for listing on Superfund National Priorities List (NPL) because of the detections of metals and organic pesticides in the soil and groundwater. The Site was finalized on the NPL in May 2000.

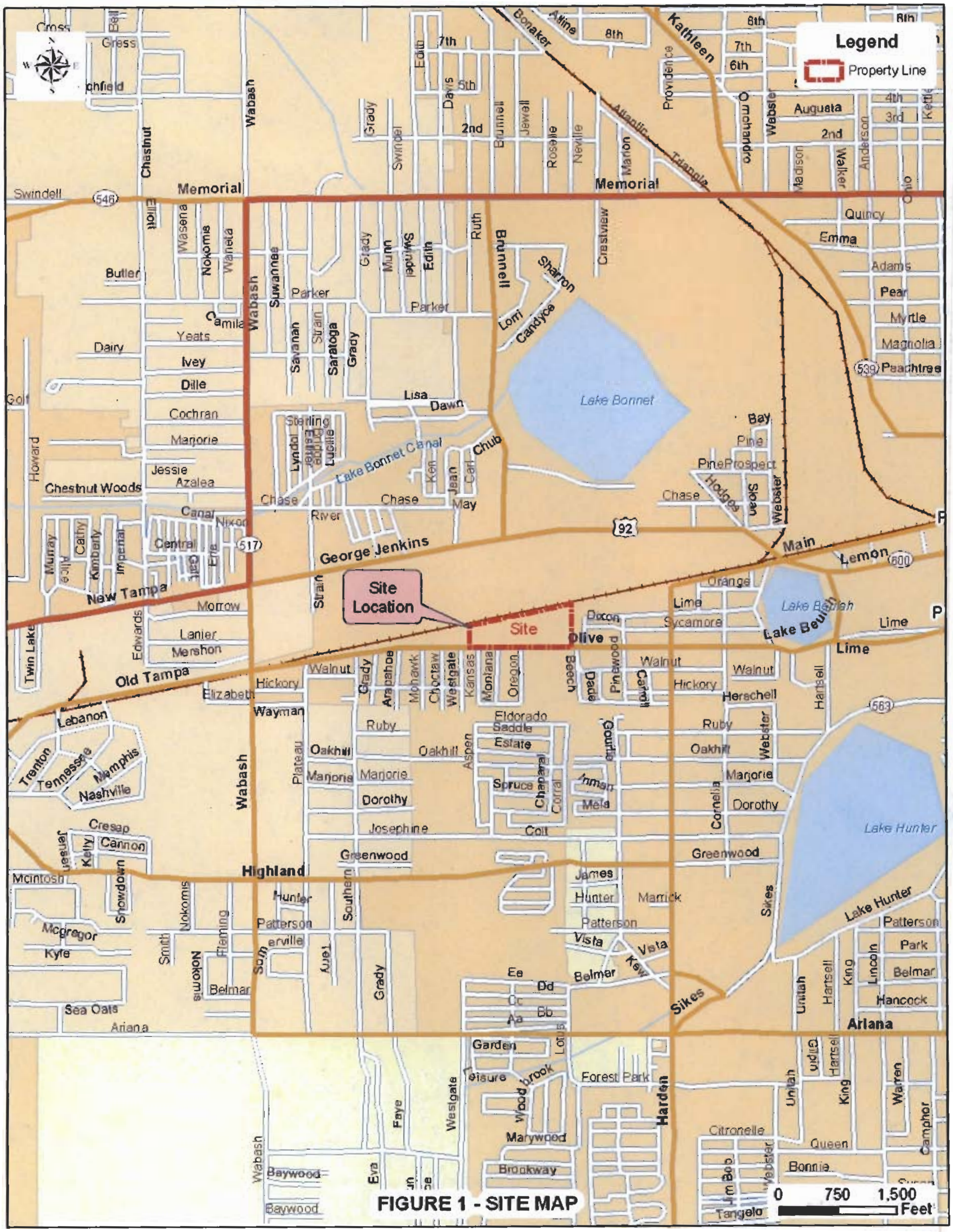


FIGURE 1 - SITE MAP

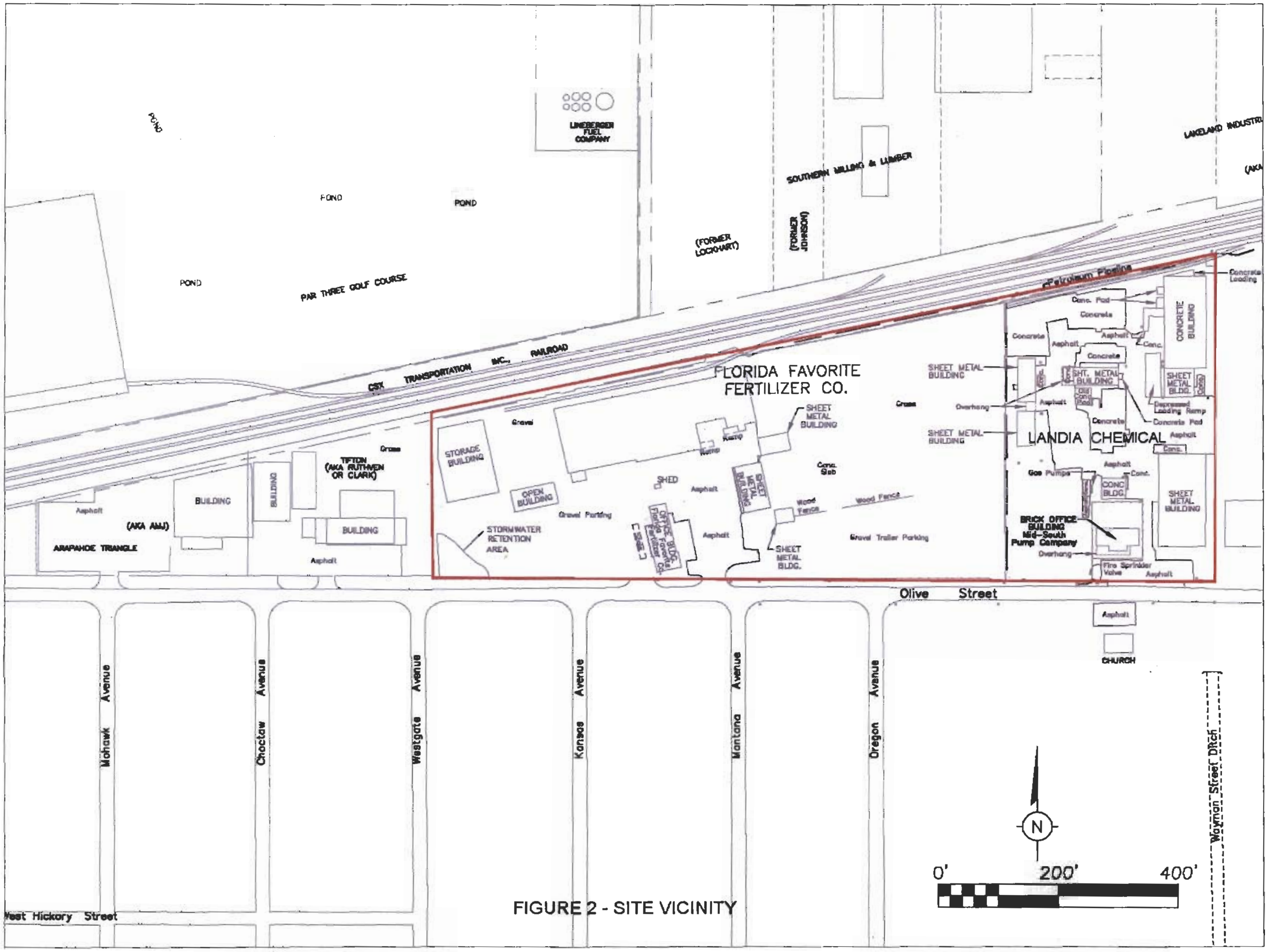


FIGURE 2 - SITE VICINITY

2.0 Site History and Enforcement Activities

2.1 History of Site Operations

The property currently owned by Landia Chemical Company at 1405 Olive Street was used for the manufacturing of various pesticides over 42 years of operation. Standard Spray and Chemical Company (SSCC) operated at this location from approximately October 1945 until November 1976. The property was sold to Agrico Chemical Company in November 1976, and then sold to Landia Chemical Company in November 1977 who operated at the facility until 1987. The property is currently leased to a manufacturer of concrete forms who uses the property primarily for storage. The principal chemicals blended or stored at the Landia property during the pesticide manufacturing operations included organophosphate pesticides, organochlorine pesticides, and various metals used in pesticide formulation.

FFF Company began fertilizer blending operations on the FFF property located at 1607 Olive Street sometime after 1935. FFF purchased the current eastern portions of the property from the City of Lakeland in 1945. FFF was incorporated after 1946. In 1992, FFF conveyed this property for a limited partnership interest in PCS JV. In 2006, PCS JV sold the property to Wedgeworth, Inc, who is the current owner and operates a similar fertilizer blending and storage facility.

2.2 Prior Federal and State Site Investigations and Removal Actions

Many site investigations and two removal actions have been conducted at the Site by FDEP, EPA and the PRPs in order to determine the nature and extent of contamination. During these investigations, many soil, sediment, surface water, and groundwater samples were collected and numerous permanent groundwater monitoring wells were installed.

The first known environmental sampling at the Site was conducted in 1983 by NUS Corporation under contract with the EPA. Later in 1983, FDEP conducted an investigation of the Wayman Street Ditch. A warning notice was issued by FDEP to the Landia Chemical Company due to the discovery of pesticide compounds in the ditch. In November 1983, Landia Chemical Company coordinated the removal of impacted sediments from the first 1,000 feet (ft) of the ditch (136 tons of sediment removed from ditch and 10 tons from the Landia property).

After the 1983 removal action was completed, additional contamination assessments were conducted either by the FDEP or by the PRPs under FDEP oversight. These contamination assessments were summarized in three reports: Contamination Assessment Report, Landia Chemical Company, (CH2MHill 1988); Contamination Assessment Report, Landia Chemical Company, (Blasland Bouck & Lee 1997); and Olive Street Contamination Study, Olive Street, Lakeland Florida, (IT Corporation 1999).

In April 1992, an underground pipeline located near the railroad in the northeast corner of the FFF property and operated by Central Florida Pipeline (CFPL), ruptured and spilled approximately 6,200 gallons of Jet-A fuel onto the Landia property between buildings in the western portions of the Site and in the southwestern corner. The product accumulated in the low elevation areas in the northern portion of the FFF property. After a Site assessment was conducted, approximately 4,500 gallons of the petroleum product and 10 cubic yards (cy) of soil were removed by CFPL contractors (ARCADIS 2003).

In June 1999, the EPA conducted an investigation of the extent of contamination in residential areas surrounding the Site. Using the results of this investigation and past contamination assessments, the Florida Department of Health (FDOH) issued a Public Health Assessment in February 2000 which concluded there was no apparent public health hazard in the residential areas and that elevated levels of contaminants were isolated and generally confined to the non-residential areas. FDOH recommended that Site access be restricted to prevent exposure to on-site surface soils and area groundwater not be used for drinking purposes. In July 1999, FDOH issued a Contaminated Groundwater Advisory for 10 blocks of the residential area south of the Site (south of Olive Street, west of Beech Avenue, east of Southern Avenue and north of the Wayman Street ditch). This advisory, in combination with the Southwest Florida Water Management District (SWFWMD) efforts to restrict permits for new wells in or near the contaminated groundwater plume precludes the public from accessing groundwater impacted by site activities on or surrounding the Site.

In late 1999, in response to findings from sampling conducted by EPA, PCS JV and Agrico Chemical Company entered into an agreement with EPA to excavate and dispose of Site soils and Wayman Street Ditch sediments that exceeded levels which posed an unacceptable short-term exposure risk. Removal of soils from the Landia property was coordinated by URS Corporation (URS, 2001) on behalf of Agrico Chemical Company and removal of soils from the FFF property, a small area of the Church property south of Olive Street, and the first 600 ft of the Wayman Street Ditch was coordinated by ARCADIS on behalf of PCS JV. Approximately 2,650 tons of soil were removed from the Landia property and 1,600 tons of soil were removed from the FFF property. In addition, approximately 510 tons of soil and sediment were removed from the off-site areas and the ditch. This action was completed in early 2001.

From 2000 to 2003, the PRPs conducted the Remedial Investigation (RI) and two risk assessments, under EPA oversight, which delineated the horizontal and vertical impacts to soil, sediment, air, surface water and groundwater from chemicals of potential concern (COPCs) and evaluated the risk associated with these contaminants. The Final RI Report was submitted to EPA in February 2003 (ARCADIS, 2003) and approved by EPA in July 2003. In order to evaluate the COPCs, refine the list to chemicals of concern (COCs), and evaluate the human health risk associated with the COCs, a Human Health Risk Assessment (HHRA) was conducted. The HHRA was submitted to EPA in July 2003 (ENSR, 2003a) and approved in August 2003. In order to evaluate the potential ecological risks due to exposure, a Screening Level Ecological Risk Assessment (SLERA) was conducted. The SLERA report (ENSR 2002) was submitted to EPA and approved in December 2003.

2.3 History of CERCLA Enforcement Activities

In 1999, EPA assumed oversight responsibilities for the Site and entered into an Administrative Order on Consent (AOC) with PCS JV to conduct a Remedial Investigation and Feasibility Study (RI/FS) at the Site. This purpose of this investigation was to further delineate the nature and extent of all Site-related contaminants, to evaluate the risks associated with these contaminants and to evaluate potential cleanup alternatives. This AOC was signed by PCS JV on October 21, 1999. In 2000 Agrico signed the AOC and has participated in conducting the RI/FS.

In May of 2000, EPA entered into another AOC with PCS JV and Agrico to perform a removal action at the Site to excavate and dispose of contaminated soil and Wayman Street ditch sediment. The purposed of the removal action was to abate the imminent and substantial endangerment to the public health, welfare or the environment posed by the Site. Both of the AOCs required PCS JV and Agrico to reimburse the response costs incurred by the United States in connection with the Landia Chemical Company site.

3.0 Community Participation

The Community Relations Plan for the Site was approved in March of 2000. EPA implemented the plan by involving the community in the all the work being conducted by the remedial and removal programs. EPA issued many fact sheets and letters, communicated with the local newspaper (the Ledger), developed videos and held public availability sessions to ensure the public was informed and was allowed to participate in the process. The following list summarizes the major community relations activities.

- September 1999 – EPA and the Florida Department of Health held the first Open House meeting to kick off the upcoming remedial investigation and discuss the findings of the draft public health assessment.
- February 2000 – EPA held another Open House meeting to present results of the sampling in the Westgate neighborhood and to discuss the upcoming removal action.
- February 2000 – EPA issued a Fact Sheet discussing how the recommendations of the Public Health Assessment would be addressed.
- March 2000 – The Florida Department of Health issued a Fact Sheet discussing the results of fish tissue sampling in the Highland Street pond.
- March 2000 - EPA approved the final Community Relations Plan and placed it in the public library.
- June 2000 - EPA prepared a video discussing the upcoming remedial and removal activities and placed it in the public library.
- July 2000 – EPA held another Open House meeting to discuss the upcoming removal action and the progress of the remedial investigation.
- September 2000 – EPA and the Florida Department of Health issued a Fact Sheet to update the Lakeland community on the progress of the removal action and the results of cancer rate and vegetable studies.
- March 2001 – EPA prepared another video discussing how the removal action was conducted and how the remedial investigation will proceed.

The RI/FS Report and Proposed Plan for the Landia Chemical Company Site in Lakeland, Florida, were made available to the public in June 2007. They can be found in the Administrative Record file and the information repository maintained at the EPA Docket Room in Region 4 and at the Lakeland Public Library, 100 Lake Morton Drive, Lakeland, Florida. The notice of the availability of these two documents was published in The Ledger on June 23, 2007. A public comment period was held from June 25, 2007 to July 25, 2007. In addition, a public meeting was held on July 10, 2007, to present the Proposed Plan to the local community in Lakeland, Florida. At this meeting, representatives from EPA answered questions about the Site and the preferred remedial alternative. EPA's response to comments received during this public comment period is included in the Responsiveness Summary, which is part of this Record of Decision.

4.0 Scope and Role of Response Action

As is typical with many Superfund sites, the problems at the Landia Chemical Site are varied and complex. As a result, EPA has organized the work into two operable units (OUs). This ROD selects the final remedy for Operable Unit 1 (OU1) and provides an interim action for OU2.

- **Operable Unit 1: Soil Contamination**

  During the two previous removal actions, a large amount of contaminated soil was excavated and disposed of in an off-site landfill. In the final remedial action, all remaining soil with site-related contaminants above selected, health based cleanup criteria or at levels which continue to impact the groundwater (which are noted in Table 5) will be excavated and disposed of in an off-site landfill. The excavated areas will be refilled with limerock and clean soil and then seeded with grass. The purpose of refilling some of the excavated areas with limerock will be to take advantage of the limerock's beneficial buffering properties in an effort to raise the pH levels in the subsurface soil and groundwater. Areas to be potentially refilled with limerock and soil will be determined in the remedial design.

  As described in the Human Health Risk Assessment, contact with Contaminants of Concern (COCs) present in the soil and groundwater in certain areas of the Site pose a risk to human health because concentrations are above applicable or relevant and appropriate requirements (ARARs) or are above EPA's acceptable level of risk ($1x10^{-4}$). The purpose of this final action is to prevent current or future exposure to soil contamination which poses a risk greater than $1 X 10^{-6}$ which has been determined by EPA to be an ARAR in the State of Florida. This will be the final response action for this Operable Unit.

- **Operable Unit 2: Groundwater Contamination**

  In-situ chemical oxidation and in-situ biodegradation will be used together to treat the areas of the most contaminated groundwater after the OU1 remedy is implemented and the contaminated soil removed. The purpose of this interim action is to quickly reduce the levels of pesticides and nitrates in the groundwater to levels that can be allowed to naturally degrade. During the remedial design, treatability studies will be conducted to determine which areas are most suited for in-situ chemical oxidation and which areas are most suited for in-situ biodegradation. In order to establish a manageable area to conduct this interim action, the areas of groundwater with contaminant levels greater than the State of Florida's Natural Attenuation Default Criteria (NADCs) were evaluated. Based on this evaluation, a boundary was established to include all areas of groundwater with contaminants greater than the NADCs north of Olive Street on the Landia and FFF properties and the property just west of the FFF property. This boundary limits the implementation of the interim action to the industrial areas, minimizes the impact to the nearby residential areas and also focuses initial groundwater cleanup activities towards the Site areas with the highest levels of groundwater contamination. It is anticipated that by treating these areas through this interim action, the overall groundwater concentrations of site-related COCs will begin to decline. Monitoring will occur on a yearly basis and at the five-year review timeframe to evaluate the effectiveness of the interim action for this Operable Unit. Based on these evaluations, a final action to treat all remaining groundwater contamination above the cleanup goals will be chosen in a final ROD.

5.0 Site Characteristics

5.1 Site Features, Topography, Surface Water and Drainage

The Site consists primarily of two properties encompassing 13 acres located on a topographic ridge that decreases in elevation to the west, north and south. There are no major surface water bodies in the vicinity of the Site. The nearest substantive surface water is approximately 1,600 feet north of the Site. Man-made retention ponds exists on the golf course property, approximately 500 feet northwest of the Site and on the southwest corner of the FFF property. The Site consists of buildings, paved and gravel areas and grassy areas. Stormwater runoff from the FFF property is currently directed to the FFF retention pond and from the Landia property to a sediment trap on the southeast corner of the Landia property. The stormwater from the Landia property is then conveyed to the Wayman Street Ditch stormwater system, a portion of which is concrete lined.

5.2 Site Hydrogeology

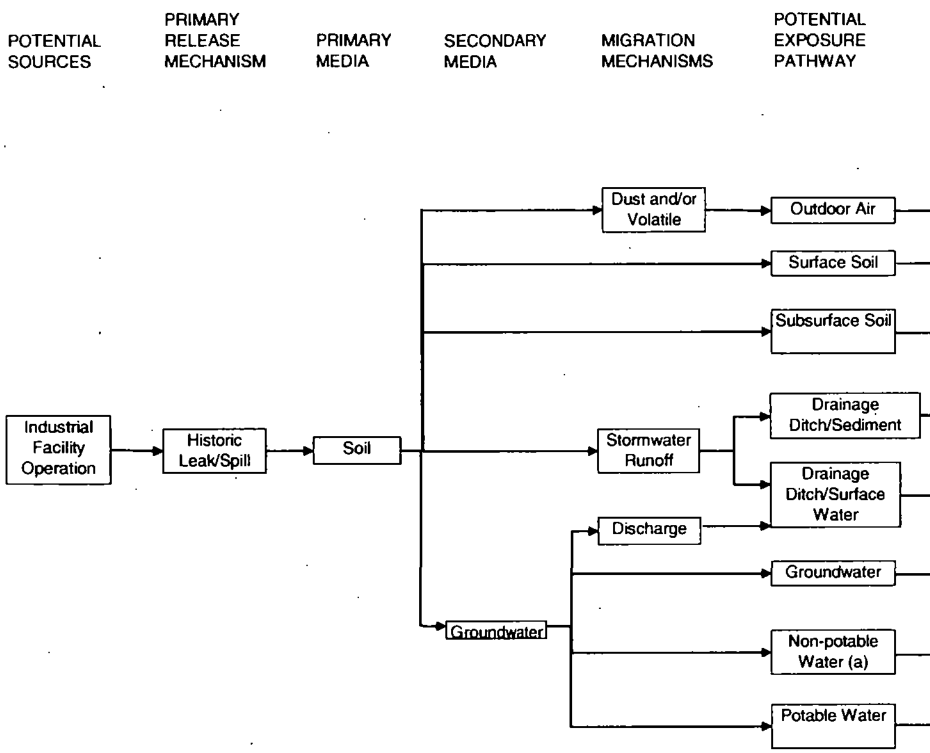
The Site conceptual model (Figure 3) encompasses an aquifer system comprised of a surficial aquifer and a deeper aquifer separated by a confining unit. The surficial aquifer has been described as two zones: an upper sandy "water table" zone with a thickness of 15 to 20 ft and an underlying "basal" zone that has higher clay content. These zones are hydraulically connected and the boundary between the two zones is a gradual transition. The total thickness of the surficial aquifer is approximately 30 to 40 ft, and in places up to 50-ft thick. The surficial aquifer is not used as a source of drinking water, but has in the past supplied irrigation water. The depth to groundwater at the Site varies seasonally, but is shallow and generally averages 3-ft below land surface (bls).

In general, the Site is on a gentle ridgeline that functions as a groundwater flow divide. Groundwater flow from the Site is downward and lateral to the north, south and west in a semi-radial flow pattern. The horizontal gradient is approximately 0.01 feet per foot (ft/ft). The underlying confining unit of the surficial aquifer consists of a clay-rich matrix with interbedded zones of sandy clay, phosphatic clay and weathered limestone cobbles which is assumed to be part of the Hawthorne Group. Beneath the confining unit is the Floridan aquifer, a regionally significant water supply source. No drinking water wells or Floridan municipal or public water supply wells were reported within a mile of the Site.

5.3 Nature and Extent of Contamination

Five groups of contaminants have been identified in environmental media at the Site. Examples of Contaminants of Concern (COCs) belonging to each group are identified below, with their associated potential health effects and routes of possible exposure. As described below further in Sections 5.3.1 and 5.3.2, various constituents have been found on-site which are not know to have been released due to operations on either the Landia property or the FFF property, and these constituents are not considered COCs at this Site.

- **Chlorinated Pesticides:** Examples of chlorinated pesticides that are COCs at the Site include chlordane, DDT, toxaphene and various isomers of benzene hexachloride (BHC) including alpha-BHC, beta-BHC, delta-BHC and gamma BHC (lindane). These chemicals are all organochlorine compounds widely used after WWII as agricultural pesticides. DDT and other chlorinated pesticides are suspect human carcinogens. Chlorinated pesticides can be absorbed into the body by skin contact or ingestion. Short-term exposure to chlorinated pesticides affects the central nervous system. Direct contact



POTENTIAL RECEPTORS

	Human				Biota	
Potential Exposure Route	On-Site Worker	Construction Worker	Resident	Trespasser	Terrestrial	Aquatic
Inhalation	●	●	●	●	●	
Ingestion	●	○	●	●		
Dermal Contact	●	○	●	●	●	
Ingestion		●				
Dermal Contact		●				
Ingestion			●			
Dermal Contact			●			●
Ingestion			●			
Dermal Contact			●			●
Ingestion		○				
Dermal Contact		○				
Ingestion			○			
Dermal Contact			○			
Ingestion			○			

Key:

● Pathway potentially complete

○ Likely that pathway will be found incomplete or insignficant

Boxes without circles indicate that pathway is not applicable to that receptor

(a) Irrigation Wells

Conceptual Site Model

Landia Site
Lakeland, Florida

Figure 3

may cause rashes or irritation of the eyes, nose or throat. Long-term exposure at low levels causes some changes in the level of liver enzymes in humans.

- **Semi-volatile Organic Compounds (SVOCs)**: SVOCs include various organic compounds composed of combinations of closed (benzene) rings, together with attached molecular structures. They occur naturally in coal, petroleum, tars, pitches, and woods, and may be formed in fires involving heavy hydrocarbon materials. Examples of SVOC's that are COCs on-site are 1,2,4-Trichlorobenzene, 2,4-Dichlorophenol, 2-Chlorophenol, and 4-Nitrophenol. The Department of Health and Human Services (DHHS) has determined that some SVOCs may reasonably be expected to be carcinogens. Some people who have breathed or touched mixtures of SVOCs and other chemicals for long periods of time have developed cancer. Some SVOCs have caused cancer in laboratory animals when inhaled (lung cancer), ingested (stomach cancer), or had them applied to their skin (skin cancer). As a class they should be treated as carcinogens and exposures should be kept to a minimum. SVOCs are generally solids and not very volatile, making dust or smoke the likely route of exposure.

- **Volatile Organic Compounds (VOCs):** Organic solvents are the group of volatile compounds or mixtures found at the Site. They are relatively stable chemically and exist in the liquid state at temperatures of approximately 32° to 82°F. Organic solvents are used for extracting, dissolving, or suspending materials such as fats, waxes, and resins that are not soluble in water. Solvents are used in paints, adhesives, glues, coatings, and degreasing/ cleaning agents. Inhalation and skin absorption are the primary routes of solvent uptake into the peripheral blood, which begins within minutes of the onset of exposure. Organic solvents undergo biotransformation or they accumulate in the lipid-rich tissues such as those of the nervous system. Solvent inhalation may cause effects ranging from an alcohol-like intoxication to narcosis and death from respiratory failure, with a spectrum of intermediate symptoms that include drowsiness, headache, dizziness, dyspepsia, and nausea. Examples of VOCs that are COCs on-site are xylene (also called methyl toluene), methylene chloride, and hexachlorobenzene. The DHHS, the International Agency for Research on Cancer (IARC) and the EPA have determined that benzene is carcinogenic to humans. Both the IARC and the EPA have found that there is insufficient information to determine whether or not xylene and ethylbenzene are carcinogenic. Studies in humans and animals generally indicate that toluene does not cause cancer.

- **Metals:** Metals that are COCs at the Site include arsenic, cadmium, chromium, and lead used in the formulation of dispersants and chelating agents; solvents; emulsifiers; spray oils; and wetting agents. Metals can enter the body by ingestion, inhalation, or direct dermal contact. Most arsenic that is absorbed into the body is converted by the liver to a less-toxic form that is efficiently excreted in the urine. Consequently, arsenic does not have a strong tendency to accumulate in the body except at high exposure levels. Inorganic arsenic has been recognized as a human poison since ancient times, and large doses can produce death. Lower levels of exposure may produce injury in a number of different body tissues or systems: these are called "systemic" effects. Cadmium, when ingested at very high levels, will severely irritate the stomach, leading to vomiting and diarrhea. Ingestion of low levels of cadmium over a long period of time may lead to kidney damage and fragile bones. Skin contact with cadmium is not known to cause health effects in humans or animals. Cadmium is a suspected inhalation carcinogen according to the DHHS. Long term exposures to high or moderate levels of chromium (VI) cause damage to the nose (bleeding, itching, sores) and lungs, and can increase your risk of non-cancer lung diseases. Ingesting very large amounts of chromium can cause stomach upsets and ulcers, convulsions, kidney and liver damage, and even death. The early symptoms of lead poisoning, as a result of overexposure (either through ingestion or inhalation) include fatigue, sleep disturbance, headache, aching bones and muscles, digestive irregularities, abdominal pains, and decreased appetite. Chronic overexposures to lead affect the central nervous system and male and female reproductive systems. Lead has also been identified as a fetotoxin.

- **Other Inorganic Constituents:** Other inorganic constituents that are COCs at the Site include sulfate and nitrate/nitrite. Sulfate is a substance that occurs naturally in drinking water. Health concerns regarding sulfate in drinking water have been raised because of reports that diarrhea may be associated with the ingestion of water containing high levels of sulfate. Of particular concern are groups within the general population that may be at greater risk from the laxative effects of sulfate when they experience an abrupt change from drinking water with low sulfate concentrations to drinking water with high sulfate concentrations. Sulfate in drinking water currently has a secondary maximum contaminant level (SMCL) based on aesthetic effects (i.e., taste and odor). Nitrate (NO_3) and nitrite (NO_2) are naturally occurring inorganic ions, which are part of the nitrogen cycle. Microbial action in soil or water decomposes wastes containing organic nitrogen first into ammonia, which is then oxidized to nitrite and nitrate. Because nitrite is easily oxidized to nitrate, nitrate is the compound predominantly found in groundwater and surface waters. Contamination with nitrogen-containing fertilizers, including anhydrous ammonia as well as animal or human natural organic wastes can raise the concentration of nitrate in water. Infants younger than 4 months of age who consume water with high nitrate levels are prone to developing acute acquired methemoglobinemia from nitrate exposure.

5.3.1 Source Materials and Soil Impacts

Historical operations at the Landia facility involved various amounts of organophosphates, organochlorines, sulfur products, and various metals used in pesticide formulation. As part of the manufacturing operations, dispersants and chelating agents; solvents; emulsifiers; spray oils; and wetting agents were also used. The manufacturing/processing area was located in the rear (north side) and central portions of the property. A former building in the central portion of the property was reportedly used as a maintenance shop. Interior areas of the facility were used for exterior storage, and during historic operations, these areas were unpaved. Several aboveground storage tanks existed. Unlined ponds along the southwestern and western boundaries of the property previously existed and received facility runoff.

The 2000 Removal Action removed much of the primary (operational) sources of pesticides and metals soil contamination at the Landia property. Secondary sources (soil impacted with pesticides and metals that may leach or be transported by wind or runoff) were either removed or covered. Impacted soil remains at isolated locations on the Landia property and may pose potential sources of impacts to groundwater. Much of the impacted soil is covered by clean soil or under concrete foundations or other locations that are not readily accessible to Site visitors/workers.

Operations at the former FFF property involve the blending of basic fertilizer products (phosphorus, potassium, nitrogen). Raw materials are delivered via railcar at the rear (north side) of the facility and transported to the main storage and formulation complex. This complex has existed in various configurations and has covered a majority of the northwestern portion of the property. A maintenance shop has been located in the approximate center of the facility. When Standard Spray and Chemical Company operated on the Landia property, the northeastern portion of the FFF property was used to store elemental sulfur on the ground prior to transfer to the Landia property. During the 2000 Removal Action, much of the source areas were removed or covered including the removal of a significant amount of sulfur. However, impacted soil with COCs above cleanup goals noted in Table 5 remain at the FFF property and represent a potential source of COC impacts to groundwater.

The Remedial Investigation (RI) was conducted from 2000 to 2003 to determine the nature and extent of the contamination at the Site. The RI employed a biased sampling approach based on data collected from previous EPA and FDEP assessments and removal actions. Soil, groundwater, sediment, and surface water were sampled to delineate the nature and extent of contamination on the Landia and FFF properties, areas south of Olive Street, and the Wayman Street Ditch.

The RI concluded that areas of soil contamination above the cleanup goals found in Table 5 are essentially limited to pesticides and metals. The distribution of these soil impacts at both the 0-2 feet and 0-3 feet range is shown in Figure 4. The COCs and their respective maximum concentrations detected in surface and subsurface soil on the Site are listed below.

- Benzene hexachloride (BHCs; more appropriately known as hexachlorocyclohexane) [1,900 mg/kg]
- 4,4'-dichlorodiphenyldichloroethane (DDD) [1,200 mg/kg]
- 4,4'-dichlorodiphenyldichloroethylene (DDE) [280 mg/kg]
- 4,4'-dichlorodiphenyltrichloroethane (DDT) [2,500 mg/kg]
- Dieldrin [140 mg/kg]
- Aldrin [18.4 mg/kg]
- Chlordane [2,100 mg/kg]
- Heptachlor [19.2 mg/kg]
- Heptachlor epoxide [12 mg/kg]
- Toxaphene [29,000 mg/kg]
- Arsenic [27.4 mg/kg]
- Cadmium [24.2 mg/kg]
- Chromium [24.4 mg/kg]
- Dioxin [662.922 pg/g TCDD equivalent]
- Lead [77.4 mg/kg]

Based on the data collected during previous studies at the Site, approximately 13,289 and 7,980 cubic yards of soil containing COCs above cleanup goals noted in Table 5 remain at the FFF and former Landia properties, respectively for a total of 23,290 cubic yards of contaminated soil.

Other constituents found on-site are not known to have been released due to operations on either the Landia property or the FFF property. As an example, PAHs sporadically detected in on-site

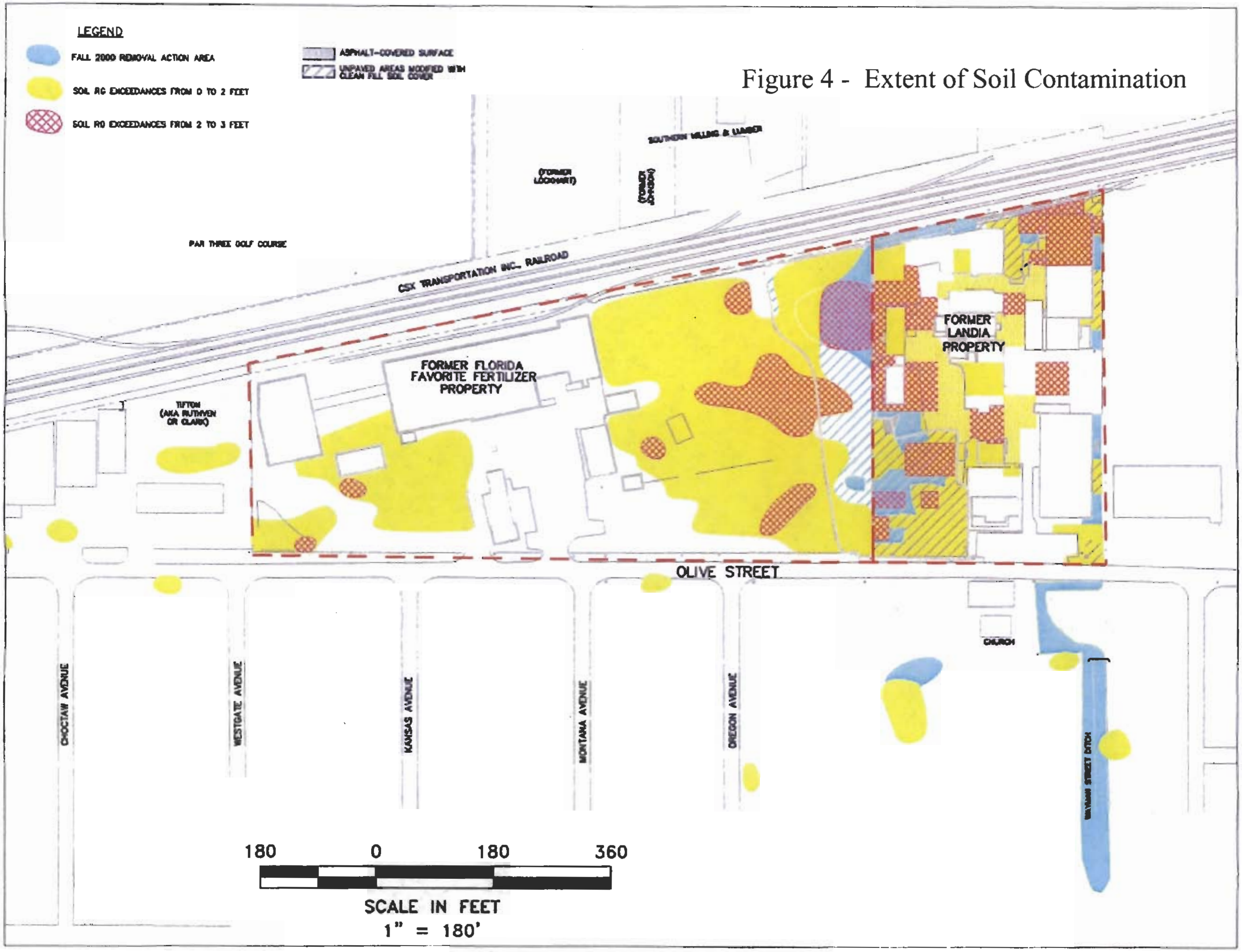


Figure 4 - Extent of Soil Contamination

soil are not associated with fertilizers or pesticides, but are associated with combustion sources such as railroads, automobiles and fuels.

In the residential area, isolated exceedances of the State of Florida's residential Soil Cleanup Target Level (SCTLs) were sporadic in distribution and exhibited no clear relation to the Site. A limited number of chlorinated pesticide compounds and metals were detected above the residential SCTLs in the residential surface soils (0 to 2 ft). The following COCs were detected in surface soil within the residential area and their maximum concentrations are provided in brackets.

- Dieldrin [0.54 mg/kg]
- Chlordane [5.4 mg/kg]
- Heptachloride epoxide [0.28 mg/kg]
- DDT [110 mg/kg]
- Arsenic [3.0 mg/kg]
- Lead [230 mg/kg]

5.3.2 Groundwater Impacts

Available data indicate that COCs (primarily chlorinated pesticides, sulfates and nitrates) have migrated through the shallow soils and impacted the surficial aquifer. The data indicate that impacts to groundwater are limited to the surficial aquifer zone, and that an aquitard prevents site-related impacts from reaching the underlying Floridan Aquifer System. COCs which have been detected in groundwater above their respective screening values are listed below along with their maximum concentrations.

- Chlordane [6.9 μg/L]
- DDD [16 μg/L]
- DDE [1.4 μg/L]
- DDT [16 μg/L]
- 4-nitrophenol [6,100 μg/L]
- Arsenic [2,100 μg/L]
- Cadmium [390 μg/L]
- Chromium [400 μg/L]
- Dieldrin [0.23 μg/L]
- Lead [2.6 mg/L]
- Methyl chloride [54 μg/L]
- Toxaphene [62 μg/L]
- Total xylenes [3,300 μg/L]
- 1,2,4-trichlorobenzene [230 μg/L]
- 2,4-dichlorophenol [2.2 μg/L]

The following sections briefly discuss the COCs found and the extent of impacts to groundwater above cleanup goals shown in Table 5 at the Site.

<u>Chlorinated Pesticides Distribution</u>

Figure 5 presents the distribution of BHC isomers in the surficial aquifer. The BHC plume extends only a short distance to the east (onto the adjacent property), to the north to George Jenkins Blvd., to the west to the Tifton property, to the southwest past Southern Avenue and to the South to just north of the Wayman Street Ditch. Other chlorinated pesticides have been sporadically detected in wells within the footprint established by the site-related BHC impacts (Arcadis 2003). Contributions to the southwest portion of the BHC plume may also be emanating from unrelated off-Site sources such as the Tifton property.

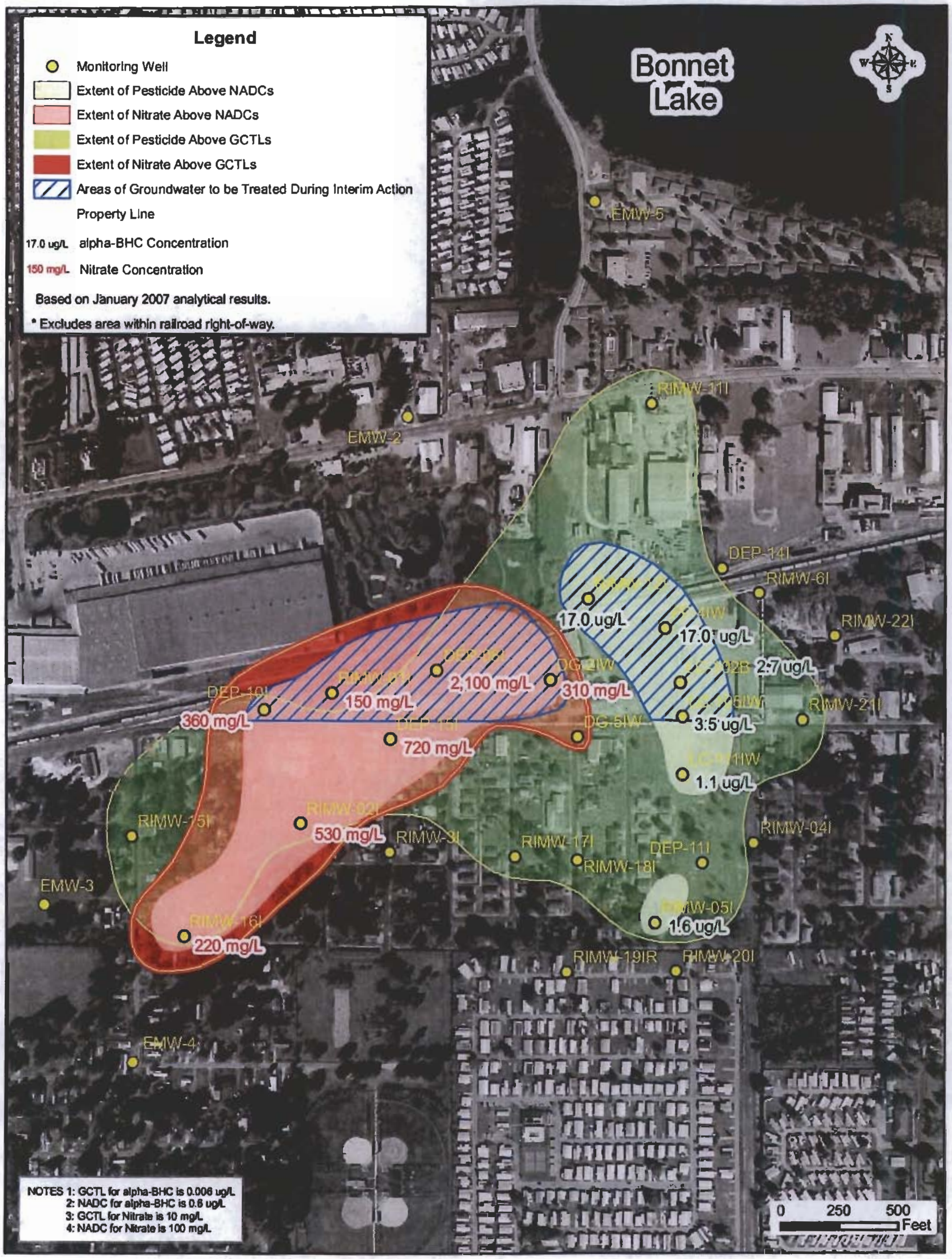


Figure 5 – Extent of Groundwater Contamination

VOC Distributions

As detailed in the RI Report, various VOCs were detected in the surficial aquifer. Most of the benzene, toluene, ethylbenzene and total xylenes (BTEX) in the surficial aquifer were found near the property boundary between the Landia and FFF properties. As indicated in the RI report, xylene derivatives and methylene chloride were used at the Site. However, it is believed that the majority of the mass of xylene in groundwater at the Site is attributable to a well documented non-Site release from the CFPL pipeline in 1992. Xylene is a component of jet fuel and is commonly found in higher concentrations in groundwater compared to other BTEX components at jet fuel spill sites. At the Landia Site, BTEX occurrence in groundwater follows the extent of the jet fuel release from the CFPL pipeline in the railroad corridor immediately north of the Site, and jet fuel accumulation between the FFF and Landia properties. The BTE impacts have thus far been considered non site-related. Chlorinated VOCs were detected at low levels in the surficial aquifer on the Landia property, however, they appear to originate from an unknown source east of the Site and are considered non site-related. The RI report concluded that the VOCs detected in groundwater other than xylenes in the off-site study areas (including Church and Tifton properties) were considered non site-related plumes emanating from potential multiple off-site sources.

SVOC Distribution

The SVOC plume is similar in extent to the VOC plume, and the key exceedances were for certain phenolic and/or naphthalene compounds. Separate and single exceedances of pentachlorophenol and bis-(2-ethylhexyl) phthalate were observed in off-site wells and therefore are not considered site-related. As indicated in the RI report, the presence of phenol to the east of the Landia property and in the southern portions of the Church property suggests a possible off-site source for the phenolic compounds.

Key Inorganic Constituents

The key inorganic constituents detected in groundwater other than metals which are described below are nitrate/nitrite and sulfate. Nitrates were detected in excess of GCTLs in the central and western portions of the FFF property, and these appear to extend to the west underneath the Tifton property and the Arapahoe Triangle (Figure 5) and southwest to the Wayman Street Ditch. Both nitrate and nitrite are considered site-related, but nitrite could be a daughter product of nitrate possibly from the denitrification process that might be naturally occurring.

In the surficial aquifer, exceedances of the Secondary MCL/GCTL for sulfate (250 mg/L) were found in an apparently continuous plume beginning underneath the FFF and Landia properties and traversing to the west underneath the Arapahoe Triangle properties. The sulfate plume extends to the north to George Jenkins Boulevard and to the south to Wayman Street Ditch.

pH Distribution

As discussed in the RI report, areas of low pH groundwater on the Site have been attributed to the storage of elemental sulfur on the ground in the northeastern corner of the current FFF property. Low pH water (as low as 1 to 2 standard units [s.u.]) originates from this area of the Site and extends southward toward Olive Street. However, more neutral pH groundwater is present at and south of Olive Street. The available data indicates an approximate background pH value of between 5 and 6 s.u. for the surficial aquifer.

Metal Distribution

As discussed in the RI report, metals that are COCs at the Site include arsenic, cadmium, chromium, and lead. Elevated arsenic groundwater concentrations exhibit a distribution very different from that exhibited by VOCs, SVOCs and chlorinated pesticides. Therefore, the RI report concluded that the arsenic is not entirely site-related. Regardless, arsenic will be addressed in the groundwater remedial action.

In addition, various other "industrial" metals (cadmium, chromium, copper, lead, nickel, antimony, vanadium, and zinc) were detected at concentrations exceeding MCLs/GCTLs in the surficial aquifer underneath the Landia and FFF properties. The isolated occurrences of copper, nickel, antimony, vanadium, and zinc that exceeded the MCLs are considered non site-related. These metals are present in areas that correspond to the area of groundwater with depressed pH as well as isolated locations across the Site and appear to be attributed to suspended or colloidal solids. A separate plume area for metals was also detected on the western side of the FFF property (near the Tifton property). This plume contains varying concentrations above the MCLs/GCTLs for some of the aforementioned metals. Apparent exceedances of thallium in isolated direct push water samples (DPWS) are considered as non site-related impacts. Similarly, the isolated exceedances for metals in groundwater in areas southeast, south, west, and southwest of the Site are also considered as non site-related impacts. Aluminum, iron and manganese were also detected in groundwater but were considered non site-related.

5.3.3 Sediment Impacts

Sampling conducted in 2006 indicated that the sediment in the Wayman Street Ditch is below FDEP SCTLs for pesticides and metals and does not require remediation to protect human health. The 2006 analytical results were consistent with 2001 sediment data confirming the effectiveness of the prior removal actions and demonstrating the Site no longer contributes to COC impacts above the cleanup goals shown in Table 5 in sediment in the ditch.

Post-RA confirmation samples and samples from unexcavated areas of the Wayman Street Ditch indicate that the north-south reach contains chlorinated pesticides above certain ecological screening values. The ditch is seasonally wet and dry, and it functions primarily as storm water drainage conveyance, rather than a true perennial surface water body with ecological habitat. Sediment samples collected during the RI from the Highland Street Pond, a sediment trap for the drainage network containing the Wayman Street ditch, indicate that the sediments in the Highland Street Pond are not impacted by the Site.

5.3.4 Surface Water Impacts

The Wayman Street Ditch receives surface water runoff from the Site and surrounding industrial and residential properties and traverses the residential area south of the Site. Surface water in Wayman Street Ditch was historically impacted by pesticides, mainly attributed to runoff from the Site and possibly from fluctuation of groundwater levels. These impacts were not observed in Highland Street Pond, downstream of the Site.

After the removal actions which addressed in part, sediments in the ditch, two surface water samples were collected in September 2001 from the concrete-lined portion of Wayman Street Ditch. An estimated value of alpha-BHC was reported for the grab sample that exceeded the Florida Freshwater Surface Water Criteria. However, the composite sample collected over a three hour period did not exceed the Florida Criteria.

6.0 Current and Potential Future Land and Resource Use

6.1 Current and Anticipated Future Land Use

The current land use of the Landia Chemical Company and former Florida Favorite Fertilizer (FFF) properties is industrial. The current land use of the properties immediately surrounding these properties is a mixture of industrial and commercial. The Site is bound to the north by an active railroad corridor and to the south by Olive Street (Figure 2). West of the Site are the Tifton and the Arapahoe Triangle properties (industrial) and immediately east of the Site is a commercial/light industrial property (Pak Teki and Consolidated Diesel) which fronts Olive Street or the first intersecting side street. The area immediately south of Olive Street is a mix of commercial and industrial properties and just south of these mixed properties is a residential area. Land immediately south of the Landia property is owned and occupied by a local religious organization (Church). To the north of the railroad right of way are several commercial/light industrial properties that front George Jenkins Boulevard. These properties include the Lakeland Industrial Park, Southern Milling & Lumber Company, Lineberger Fuel Company, and the YMCA Golf Course property.

Restrictive covenants will be placed on the Landia and former FFF property deeds to limit the future use of the two properties to industrial. The reasonably anticipated future land use of the properties to the east, west and north of the Site is expected to remain commercial and/or industrial. This is primarily due to the location (easy access to rail and U.S. Interstate 4), the increasing value of industrial and commercial properties, and the overall growth of the Central Florida area. The reasonably anticipated future land use of the properties along George Jenkins Boulevard and Olive Street is expected to remain commercial primarily due to the same factors. The reasonably anticipated future land use of the residential area is expected to remain residential. It has been an established neighborhood for many years and it is affordable and located very near downtown Lakeland.

6.2 Current and Anticipated Future Resource Use

Even though the groundwater beneath the Site and the surrounding area is classed as a potential drinking water aquifer by the State of Florida, it is not currently being used as a drinking water supply. The drinking water supply for the Site and the surrounding area is provided by the City of Lakeland and is drawn from deep Floridan Aquifer wells, with the nearest public well field over one mile to the northeast of the Site. Three private irrigation wells were identified during the RI. However, it was confirmed during the RI that these wells were inactive.

Access to impacted groundwater on and surrounding the Site is restricted. In 1999, the FDOH issued a Contaminated Groundwater Advisory for the residential area south of the Site. This advisory requested that permits for new wells be restricted, assisting in preventing the public from accessing groundwater impacted with COCs above cleanup goals shown in Table 5 on or surrounding the Site until cleanup standards are reached. In the future, after the cleanup goals are attained, the aquifer could be used as a drinking water supply if needed and appropriate.

Current surface water uses related to the Landia property consist of a small water body on the property and storm water runoff from the Landia property into the Wayman Street Ditch. The water body on the property is an abandoned, flooded loading ramp which is recharged with groundwater. This water body will not be present in the future. It will be filled with soil during the remedial action to prevent potential exposure to contaminated groundwater. An approximately 4-6 feet long Florida alligator currently lives in the water body and will be relocated prior to the water body being filled with soil.

7.0 Summary of Site Risks

The purpose of the baseline risk assessment is to estimate what risks the Site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline risk assessment and the process used for selection of cleanup goals found in Table 5 for the Chemicals of Concern (COCs) at the Landia Chemical Company Site.

Under the NCP, EPA's goal is to reduce the excess lifetime cancer risk to the range of 1×10^{-4} to 1×10^{-6} for the expected future land use at the Site. However, the passage of Florida Statute Chapter 376 in 2005, required cleanups in the State of Florida to reduce the excess lifetime cancer risk to 1 X 10^{-6} and a hazard index of 1 or less for noncarcinogens. This occurred after the Human Health Risk Assessment (HHRA) was conducted and approved for this Site. Therefore, the COCs for soil and groundwater were further refined in the Feasibility Study (FS) to establish cleanup goals which would attain the 1 X 10^{-6} risk requirement for carcinogens and a hazard index of 1 or less for noncarcinogens, and the calculated leachability numbers described in Section 7.1.5.

In addition to refining the soil COCs to meet the 1 X 10^{-6} risk requirement and hazard index of 1 or less, the FS also further evaluated the soil COCs on the industrial properties to ensure that soil contaminants would not be present at levels on site which would leach into the groundwater above groundwater COCs (leachability numbers). As a result the final soil cleanup goals for the industrial properties (Landia, and former FFF properties) were selected to meet the lower of the 1 X 10^{-6} carcinogenic risk requirement and a hazard index of 1 or less for noncarcinogens based on industrial direct exposure and the leachability number. Soil cleanup goals for the residential areas were selected based solely on attaining the 1 X 10^{-6} cancer risk requirement and a hazard index of 1 or less for noncarcinogens based on residential, direct contact exposure. Where Florida Soil Cleanup Target Levels (SCTLs) existed and were health based, EPA opted to select these criteria as COCs, if the Florida target levels were more protective.

Contaminant concentrations in the groundwater must ultimately be reduced to meet drinking water standards because the impacted groundwater aquifer is a potential drinking water source and a resource of the State of Florida. Therefore, EPA determined that rather than evaluate groundwater contaminants in the HHRA, it would be more appropriate to select COCs and cleanup goals based on a comparison of federal and state drinking water standards. The maximum groundwater contaminant concentrations were compared to the State of Florida and Federal promulgated drinking water standards (Maximum Concentration Levels or MCLs). Where MCLs were not available, Florida Groundwater Cleanup Target Levels (GCTLs) were used where they were health based. Groundwater cleanup goals were selected based on attaining either the most stringent MCL or the GCTL if no MCL were promulgated.

The following sections describe this process beginning with the development of the HHRA, the refinement of COCs to meet the 1 X 10^{-6} cancer and noncancer hazard index of 1 or less requirements, the development of leachability numbers, the evaluation of ecological risks through the Screening Level Ecological Risk Assessment (SLERA) and the selection of cleanup goals.

7.1 Summary of Human Health Risk Assessment

Between 2002 and 2003, a Human Health Risk Assessment (HHRA) was conducted to evaluate potential risks to human health associated with chemicals detected in soil, surface water, and sediment samples collected from the Site and neighboring off-site locations. For the evaluation of soil impacts, the study area was divided into industrial areas; generally the area north of Olive Street up to and including the railroad tracks (Figure 2) and residential areas for the remaining areas south of Olive Street.

The HHRA found that the risk from probable exposure to surface soil in the industrial area by an on-site worker exceeds 1×10^{-4}, thereby triggering further action under Superfund. The HHRA found that the risk from probable exposures to surface soil, sediment and surface water in the residential area does not exceed 1×10^{-4} but does exceed 1×10^{-6} in some areas.

7.1.1 Chemicals of Concern

Soil data were divided into industrial and residential areas. Based on past and current land use, the industrial areas were further divided into the following separate industrial areas: East of Landia, Landia Chemical, FFF, Tifton and Arapahoe Triangle. EPA determined that it is likely that different worker receptors could be exposed to each of these properties. The residential area is located south of the industrial area. Surface soil samples were collected from all residential properties abutting the Wayman Street ditch between the Site and Plateau and randomly throughout the remaining neighborhood between Olive Street and the Wayman Street ditch. Surface soil in the residential area was evaluated on a sample-by-sample basis, since each sample generally represented an individual house. It is likely that residential receptors could be exposed to soil only in their backyards. Therefore, each sample was evaluated separately and was not grouped into exposure areas. Subsurface soil in the residential area was considered to be one exposure area. EPA determined that a future construction worker receptor has equal likelihood of contacting subsurface soil in the entire residential area.

Chemicals in surface and subsurface soil in the five industrial exposure areas were compared to background levels and industrial screening criteria. Industrial soil screening criteria were defined as the lower of the U.S. EPA Region 9 Preliminary Remediation Goals (PRGs) for industrial soil using a hazard index of 0.1 for noncarcinogens, and Florida SCTLs found in F.A.C., Chapter 62-777 for industrial soil. Chemicals in surface and subsurface soil in the residential area were compared to residential soil screening criteria, which were defined as the lower of the U.S. EPA Region 9 PRGs for residential soil using a hazard index of 0.1 for noncarcinogens and the Florida SCTLs for residential soil. Most of the residential surface soil samples had only one or two COPCs.

Chemicals in groundwater were compared to groundwater screening criteria. Groundwater screening criteria were defined as the lower of the Florida or Federal MCL. U.S. EPA Region 9 PRGs for tap water using a hazard index of 0.1 for noncarcinogens, were used for chemicals where neither Florida nor Federal MCLs were available.

Surface water and sediment samples were collected from the Wayman Street ditch and the Highland Street Pond. It was assumed that a residential child receptor could have equal access to all of the sample locations, therefore the surface water and sediment samples were grouped into one exposure area. Chemicals in surface water were compared to surface water screening criteria. Surface water screening criteria were defined as the lower of the FDEP Surface Water Cleanup Target Levels (SWCTL) and the National Recommended Ambient Water Quality Criteria (AWQC) for consumption of water and organisms. The U.S. EPA Region 9 PRGs for tap water were used if no AWQC was available. Chemicals in sediment were compared to residential soil screening criteria defined above.

As discussed above, the COPCs in the HHRA were later refined in the FS to meet the 1 X 10^{-6} risk requirement for carcinogens, a hazard index of 1 or less for noncarcinogens, and/or to meet leachability numbers. Table 1 presents the minimum and maximum detected concentrations, frequency of detection, and maximum exposure point concentrations for the final soil COCs selected for the residential area after refinement in the FS. Table 2 presents this information for the soil COCs selected for the industrial areas based soley on direct contact exposure.

7.1.2 Exposure Assessment

The HHRA evaluated potential exposure through a number of exposure scenarios, including current and potential future exposure scenarios for industrial and residential areas. The industrial areas were divided into east of Landia, Landia Chemical, FFF, Tifton, and Arapahoe Triangle. The receptors evaluated for the industrial areas include an on-site worker, construction worker, and trespasser. The residential area is located south of the industrial area. It was assumed that adult and child residents could be exposed to surface soil in the residential area on a house-by-house basis. It was also assumed that the child resident could be exposed to surface water and sediment in the Wayman Street Ditch and the Highland Street Pond. It was assumed that a construction worker could be exposed to surface and subsurface soil in the residential area. The conceptual site model, Figure 3, presents the potential exposure pathways.

For each route of exposure, a reasonable maximum exposure (RME) scenario was developed based on EPA's Risk Assessment Guidance for Superfund (RAGS) and EPA Region 4 Human Health Risk Assessment Bulletins – Supplement to RAGS. The specific exposure factors used for calculating risks at the Site are provided in the HHRA.

Incidental ingestion and dermal contact with surface soil and inhalation of fugitive dust in outdoor air at the five industrial areas was evaluated for an on-site worker and a trespasser. Incidental ingestion and dermal contact with subsurface soil and inhalation of fugitive dust in outdoor air at the five industrial areas and the residential area was evaluated for a construction worker using an RME.

Incidental ingestion and dermal contact with surface soil, inhalation of fugitive dust in outdoor air, and incidental ingestion and dermal contact with surface water and sediment were evaluated using an RME for an adult and child resident. Incidental ingestion and dermal contact with subsurface soil and inhalation of fugitive dust in outdoor air was evaluated for a construction worker.

No exposure pathways were identified for groundwater under current conditions because groundwater in the area is not being used as potable water. A Contaminated Groundwater Advisory was issued by the FDOH in 1999 for the residential area south of the Site. This advisory requested that permits be restricted for new wells, assisting in preventing the public from accessing groundwater impacted by site activity. In the 2000 Public Health Assessment, FDOH also recommended that Site access be restricted to prevent exposure to on-Site surface soils.

Table 1

Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations (Residential)

Scenario Timeframe: Current and Future

Medium: Soil

Exposure Medium: Soil

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection (detection/ # samples)	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Offsite Soil Residential Area Direct Contact	4,4-DDD	0.0007	13	Ppm	14/109	13	ppm	Max
	4,4-DDT	0.0007	30	Ppm	69/109	30	ppm	Max
	Aldrin	0.0006	0.12	Ppm	4/109	0.12	ppm	Max
	alpha-BHC	0.0003	0.29	ppm	5/109	0.29	ppm	Max
	alpha-Chlordane	0.004	3.7	ppm	12/109	3.7	ppm	Max
	Arsenic	0.52	3.0	ppm	15/109	3.0	ppm	Max
	Chlordane (technical)	0.12	8.2	ppm	10/109	8.2	ppm	Max
	Dieldrin	0.0004	0.22	ppm	52/109	0.22	ppm	Max
	Heptachlor	0.0002	0.29	ppm	17/109	0.29	ppm	Max
	Heptachlor epoxide	0.0008	0.28	ppm	25/109	0.28	ppm	Max
	Lead	2.7	120	ppm	107/109			
	Toxaphene	0.078	11	ppm	3/109	11	ppm	Max

ppm: parts per million

Table 2

Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations (Industrial Area)

Scenario Timeframe: Current and Future

Medium: Soil

Exposure Medium: Soil

Exposure Point	Chemical of Concern	Concentration Detected		Units (ppm = parts per million)	Frequency of Detection (detection/ # samples)	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Onsite Soil Industrial Area Direct Contact	4,4-DDE	0.003	20	ppm	107/142	20	ppm	Max
	Aldrin	0.00005	370	ppm	20/106	370	ppm	Max
	alpha-Chlordane	0.0007	77	ppm	95/103	77	ppm	Max
	Arsenic	0.41	189	ppm	57/140	189	ppm	Max
	Chlordane (technical)	0.023	100	ppm	35/37	100	ppm	Max
	Dioxin (TEQ)	(1)						
	Heptachlor	0.0008	31	ppm	44/120	31	ppm	Max
	Heptachlor epoxide	0.002	0.7	ppm	25/106	0.7	ppm	Max
	Hexachlorobenzene	(2)						
	Lead	4.6	1020	ppm	125/127			
	Toxaphene	0.12	1500	ppm	30/124	1500	ppm	Max

(1) Dioxin was sampled and evaluated separately from the other soil contaminants in the industrial area. The primary extent of dioxin contamination was found to be on the FFF property. The cleanup goal was established to be consistent with the 1 X 10^{-6}risk requirement.

(2) Hexachlorobenze was selected as a COC during refinement.

7.1.3 Toxicity Assessment

The purpose of the toxicity assessment is to identify the types of adverse health effects a chemical may potentially cause, and to define the relationship between the dose of a chemical and the likelihood or magnitude of an adverse effect (response) (U.S. EPA, 1989a). Adverse effects are classified by USEPA as potentially carcinogenic or non-carcinogenic (i.e., potential affects other than cancer). Dose-response relationships are defined by USEPA for oral exposure and for exposure by inhalation. Oral toxicity values are also used to assess dermal exposures, with appropriate adjustments, because USEPA has not yet developed values for this route of exposure. Combining the results of the toxicity assessment with information on the magnitude of potential human exposure provides an estimate of potential risk.

Sources of the published toxicity values in the risk assessment include U.S. EPA's Integrated Risk Information System (IRIS) (U.S. EPA, 2002a), the Health Effects Assessment Summary Tables (HEAST) (U.S. EPA, 1997b), and the USEPA National Center for Environmental Assessment (NCEA) in Cincinnati, Ohio.

7.1.4 Risk Characterization

For carcinogens, risks are generally expressed as the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

$$\text{Risk} = \text{CDI} \times \text{SF}$$

where: risk = a unitless probability (e.g., 2×10^{-5}) of an individual developing cancer

CDI = chronic daily intake averaged over 70 years (mg/kg-day)

SF = slope factor, expressed as (mg/kg-day)-1.

These risks are probabilities that usually are expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime cancer risk of 1×10^{-6} indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer that individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual developing cancer from all other causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for site-related exposures is 1×10^{-4} to 1×10^{-6}. As discussed previously, the COCs for soil and groundwater at this site were further refined in the Feasibility Study (FS) to establish cleanup goals which would attain the State of Florida's 1×10^{-6} cancer risk for carcinogens and a hazard index of 1 or less for noncarcinogens.

The potential for non-carcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., life-time) with a reference dose (RfD) derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ<1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic non-carcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all COPCs that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HI<1 indicates that, based on the sum of all HQ's from different contaminants and exposure routes, toxic non-carcinogenic effects from all contaminants are unlikely. An HI>1 indicates that site-related exposures may present a risk to human health.

The HQ is calculated as follows:

Non-cancer HQ = CDI/RfD

where: CDI = chronic daily intake
RfD = reference dose.

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term).

The target cancer risk and hazard index (HI) levels used for the identification of chemicals of concern (COCs) are based on EPA (EPA, 1991) and EPA Region 4 guidance (EPA, 2000a). The results of the risk characterization show that chemicals detected in the residential area in surface soil, subsurface soil, sediment and surface water do not pose unacceptable risks. The predicted cancer risk levels are all below $1x10^{-4}$, and the non-carcinogenic HIs are all below 1.

The predicted carcinogenic risk levels for surface soil exceed $1x10^{-4}$ at FFF and Landia Chemical. The non-carcinogenic HIs also exceed 1 at Landia Chemical. These results indicate that, based on the exposure point concentrations and exposure assumptions used in the HHRA, further action is warranted at these industrial areas. The majority of the predicted risk levels in surface soil are due to the BHCs, dieldrin and toxaphene at FFF and alpha-BHC and DDT at Landia Chemical. The majority of the predicted risk levels in subsurface soil are due to DDT and dieldrin at FFF and toxaphene and chlordane at Landia Chemical. In the HHRA, risk assessment cleanup goals were calculated for chemicals with carcinogenic risk levels above $1x10^{-6}$ or HI above 1.

7.1.5 Refinement of COCs

After the HHRA was approved in 2003, Florida adopted Florida Statute Chapter 376 in 2005 which required cleanups in the State of Florida to reduce the excess lifetime cancer risk to $1 X 10^{-6}$ and a noncarcinogenic hazard index of 1 or less. In the Feasibility Study, COCs were refined to ensure that all COPCs which exceeded the $1 X 10^{-6}$ cancer risk and a hazard index of 1 or less criterias were retained as COCs. Soil COPCs were also screened to determine if they exceeded the leaching default criteria and if so, were further evaluated.

For constituents in soil that exceeded the leaching default criteria only, the COPC was retained if present in groundwater above the default GCTL. The leaching pathway is relevant only if groundwater concentrations beneath or downgradient of an area of contaminated soil location exceed the GCTL for the contaminant in the soil. FDEP and EPA guidance acknowledges the leaching pathway is incomplete if a COPC is not detected in groundwater above the GCTL after having sufficient time to leach from soil to groundwater.

The synthetic precipitation leaching procedure (SPLP) test results and the FDEP leaching-based SCTLs were compared to groundwater concentrations in the nearest downgradient well for the pesticides of interest at the Site. Out of the 180 samples that were compared, in only two cases (1.1%) were the leachate concentrations below the GCTLs and the groundwater concentration in the downgradient well was above the GCTLs. In 87% of the comparisons, the downgradient groundwater concentrations were below the leachate concentration. This showed that the SPLP tests were appropriate to evaluate leaching pathways and the FDEP leaching-based SCTLs were conservatively protective of the leaching pathway. In some instances, the FDEP leaching- based SCTLs may have been overly protective of leaching pathways where soil concentrations exceed the leaching-based SCTLs but the downgradient groundwater concentrations were below the GCTLs.

For constituents in soil that were retained for leaching after the above screening steps, alternate site specific leaching SCTLs were developed in accordance with the Equation for the Determination of SCTLs based on Leachability included as Figure 8 in the Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777 F.A.C. (FDEP, 2005).

The site-specific parameters used in the development of the site-specific leaching-based SCTLs were the soil-water partition (Kd) data calculated from SPLP data and a site-specific, COC specific dilution factor (DF). All other parameters used in the calculations were FDEP default values.

The Kd calculated for the three methods was compared to the Kd provided in Table 4 (Chemical Specific Values) of the Technical Report: Development of Soil Target Cleanup Levels (SCTLs) for Chapter 62-777, F.A.C. Of the pesticides analyzed, the FDEP default value for Kd, which is used to develop the leaching-based SCTLs, is lower than the site-specific Kd for all three calculation methods for alpha-BHC, beta-BHC, delta-BHC, gamma-BHC (lindane), chlordane (technical), and dieldrin. For 4,4'-DDE, 4,4'-DDT, and aldrin, the FDEP Kd value falls within the range of site-specific values. A higher Kd value means a constituent is more likely to sorb to soil or, that is, less likely to leach to groundwater. Therefore, the SPLP data indicates that for alpha-BHC, beta-BHC, delta-BHC, gamma-BHC (lindane), chlordane (technical), and dieldrin, the default leaching-based SCTL is overly conservative. The other three constituents have site-specific Kd values that are near the FDEP default Kd values.

The DF was calculated using the equation presented in EPA's Soil Screening Guidance: User's Guide (1996). Site-specific values for hydraulic conductivity, hydraulic gradient, mixing zone depth, infiltration rate, and source length were used to calculate the DF for each COC.

Overall, the site-specific leaching-based SCTLs can change significantly based on the DF; the higher the DF, the higher the SCTL and vice versa. FDEP's default DF in the development of leach based SCTLs is 20; however, the site-specific DF varied between 7 and 10. A major assumption in the determination of the DF is the length of the source term parallel to groundwater flow. A longer source length results in a lower DF, whereas a shorter source term length results in a higher DF.

The cleanup goals for soil and groundwater were selected after evaluating potential risks from COPCs in the HHRA, further refining them to meet Florida's requirement that cleanups meet a 1×10^{-6} cancer risk and noncancer hazard index of 1 or less, and evaluating soil contaminants to ensure protection of groundwater. These cleanup goals along with the basis for their selection are found in Section 12.2.4, Table 5.

7.1.6 Uncertainty

The large number of assumptions made in the risk characterization introduces uncertainty in the results. While this approach could potentially underestimate potential risk, the use of numerous, conservative (i.e., protective of human health) assumptions, in the risk characterization, typically overestimates potential risk. Any one person's potential exposure and subsequent risk are influenced by all the parameters utilized in the HHRA and will vary on a case-by-case basis. Despite inevitable uncertainties associated with the steps used to derive potential risks, the use of numerous health-protective assumptions will most likely lead to a very large overestimate of potential risks from the Site. Moreover, when evaluating risk assessment results, it is important to put the risks into perspective. For example, the background rate of cancer in the U.S. is approximately 2,500 for a population of 10,000 people (Landis, et al., 1998). The results of the risk assessment must be carefully interpreted considering the uncertainty and conservatism associated with the analysis, especially where site management decisions are made.

Uncertainties associated with the HHRA include uncertainties related to data evaluation, exposure pathways and parameters, toxicity, and risk characterization, as discussed in the following paragraphs.

Data Evaluation

The purpose of data evaluation is to determine which constituents, if any, are present at the Site at concentrations requiring further investigation. The screening process used to select COPCs to evaluate in the BHHRA was intended to include all chemicals with concentrations high enough to be of concern for the protection of public health.

Uncertainty with respect to data evaluation can arise from many sources, such as the quality and quantity of the data used to characterize the Site, the process used to select data to use in the risk assessment, and the statistical treatment of data.

Exposure Pathways and Parameters

The exposure assumptions directly influence the calculated doses (daily intakes), and ultimately the risk calculations. For the most part, site-specific data were not available for this BHHRA; therefore, conservative default exposure assumptions were used in calculating exposure doses such as the selection of exposure routes and exposure factors (e.g., contact rate). In most cases, this uncertainty may overestimate the most probable realistic exposures and, therefore, may overestimate risk. This is appropriate when performing risk assessments of this type so that the risk managers can be reasonably assured that the public risks may not be underestimated, and so that risk assessments for different locations and scenarios can be compared.

In order to estimate a receptor's potential exposure at a site, it is necessary to determine the geographical location where the receptor is assumed to be exposed. Once the area of interest has been defined, the appropriate data can be selected and the exposure point concentration can be calculated. The primary source of uncertainty associated with estimating exposure point concentrations involves the statistical methods used to estimate these concentrations and the assumptions inherent in these statistical methods. Generally, an upper bound estimate of the mean concentration is used to represent the exposure point concentration instead of the measured mean concentration. This is done to account for the possibility that the true mean is higher than the measured mean because unsampled areas of the Site may have higher constituent concentrations.

Generally, in order to present a range of possible exposure estimates, a central tendency risk describer is calculated in addition to the reasonable maximum exposure risk, in accordance with Region 4 policy. The reasonable maximum exposure approach characterizes risk at the upper end of the risk distribution, while the central tendency approach characterizes either the arithmetic mean risk or the median risk. The inclusion of both reasonable maximum exposure and central tendency risk describers provides perspective for the risk manager. However, the National Contingency Plan (NCP) Section 300.430(d) states, "The reasonable maximum exposure estimates for future uses of the site will provide the basis for the development of protective exposure levels."

Toxicity Assessment

For a risk to exist, both significant exposure to the chemicals of potential concern and toxicity at these predicted exposure levels must exist. The toxicological uncertainties primarily relate to the methodology by which carcinogenic and noncarcinogenic criteria (i.e., CSFs and reference doses) are developed. In general, the methodology currently used to develop CSFs and reference doses is very conservative, and likely results in overestimation of human toxicity.

Risk Characterization

Ideally, areas of exposure should be defined based on actual exposures or known behaviors of receptors at the Site. Often, however, as in the case of this risk assessment, this information is unavailable. Lacking absolute knowledge about the behaviors of receptors at or near the Site, it was necessary to make some assumptions. This risk assessment made assumptions about exposure units (or areas) based on contaminant distribution and likely areas of exposure based on Site features. Such assumptions will add to the uncertainty in the HHRA.

Each complete exposure pathway concerns more than one contaminant. Uncertainties associated with summing risks or hazard quotients for multiple substances are of concern in the risk characterization step. The assumption ignores the possibility of synergistic or antagonistic activities in the metabolism of the contaminants. This could result in over-or under-estimation of risk.

The potential risks developed for the Site were directly related to COPCs detected in the environmental media at this Site. No attempt was made to differentiate between the risk contributions from other sites and those being contributed from this Site.

All of the uncertainties discussed above ultimately effect the risk estimate. Most of the uncertainties identified will result in the potential for overestimation of risk (e.g., the combination of several upper-bound assumptions for some exposure scenarios).

As discussed in the previous section, the COPCs from the HHRA were refined in the FS and the final cleanup goals were established based on achieving a 1×10^{-6} risk for carcinogens, a hazard index of 1 or less for noncarcinogens, or for protection of groundwater (leachability). Where Florida Soil Cleanup Target Levels (SCTLs) and Groundwater Cleanup Target levels existed and were health based, EPA opted to select these criteria as COCs, if the Florida target levels were more protective. For those two groundwater contaminants (2,4-dichlorophenol and xylene) for which the Florida GCTL were not entirely health based, EPA developed health based cleanup goals to achieve 1×10^{-6} risk. Therefore, the fact that cleanup goals were selected based on regulatory requirements rather than from the HHRA makes any uncertainty that would either overestimate or underestimate the risk in the HHRA irrelevant.

7.2 Summary of Ecological Risk Assessment

7.2.1 Screening Level Ecological Risk Assessment (SLERA)

A SLERA was conducted in 2003 following EPA Region 4 (2001a) draft guidance, and satisfies Steps 1 and 2 of the national EPA (1998) Guidance for Superfund. Potential ecological risks due to exposure to three environmental media (surface soil, sediment, and surface water) were evaluated in four exposure areas. Surface soil was evaluated in the Industrial Area and the Church Property/Field Area. Sediment and surface water were evaluated in the Wayman Street ditch and Highland Street Ponds. Maximum detected concentrations or maximum detection limits of each constituent measured in each exposure area were compared to EPA Region 4 screening values. The list of screening level contaminants retained in the SLERA were evaluated to help refine the COPCs and to determine the need for future ecological risk evaluation at this industrial facility. This refinement is the basis for Step 3 (Problem Formulation) of the EPA Superfund guidance.

Based on the screening results and development of the Problem Formulation, no additional ecological risk activities at the Site were recommended in the SLERA. This conclusion was based on the following lines of evidence developed in the SLERA and Problem Formulation:

- Following the refinement of COPCs, pesticides in the Industrial Area surface soil are the primary constituents of potential concern to ecological receptors. Given the relatively limited ecological habitat in this area, additional ecological risk assessment activities are not warranted. Should the Industrial Area be subject to a soil removal or remedial action due to human health concerns; it is highly likely that any potential ecological exposure pathways will also be eliminated.

- Some constituents in surface soil samples from the Church Property/Field Area were detected at concentrations that exceeded ecological screening values. The maximum detected COPC concentration used was measured in a sample collected adjacent to Wayman Street, and may be related to urban contamination from Wayman Street or the other roads adjacent to the Church Property/Field Area.
- With the exception of inorganic constituents, all detected constituents in surface water had hazard quotients (HQs; defined as the exposure point concentration divided by the screening value) < 1. The surface water constituents with HQ > 1 are inorganic constituents, which were measured as total recoverable, but compared to dissolved phase benchmarks. If dissolved inorganic constituents data were available, these constituents may have HQ < 1. Since these inorganic constituents, with the exception of lead, have not been directly linked to the Site, the inorganic constituents detected in surface water are probably present due to stormwater runoff from the surrounding urban area.
- Five COPCs were identified in the Wayman Street Ditch sediment. Three of the COPCs are constituent groups. Dieldrin and two of the three constituent group COPCs include detected constituents. Toxaphene and total PAH were not detected in the sediments. Maximum detected concentrations of dieldrin and total DDx were lower than acute level screening values.

7.2.2 Uncertainty

The SLERA was based on data that have been collected for a number of years, and was developed using the most recent EPA guidance for preparing ecological risk assessments. However, as methods are improved, differences in the best available technology for sample collection, storage, clean-up, and analysis may lead to variability, as well as uncertainty, with the data. Because some of the data for this risk assessment are several years old, the conditions that are represented by the older data may not be the same as current conditions, particularly for constituents that are biodegradable or photodegradable. Some of the historical data were collected using focused environmental sampling techniques, which were intended to characterize constituent concentrations and delineate the boundaries of the areas of highest contamination. Ecological receptors integrate exposure over time and space. Focused sampling may therefore have contributed to an overestimate or underestimate of exposure point concentrations. Finally, data quality was not adequate to fully evaluate the potential risks to ecological receptors because many detection limits exceeded Region 4 screening values. These constituents with detection limits above screening values were not detected, but were retained as SLCOPCs in the SLERA. This may contribute to an overestimate of exposure point concentrations for these constituents.

Another source of uncertainty is the SLCOPCs for which there was no screening benchmark. Further investigation and evaluation would be required to establish whether these SLCOPCs pose a potential risk. EPA extrapolated the potential for population, community, or ecosystem effects for these SLCOPCs based on the examination of the potential effects of these SLCOPCs on one or more representative species which may not be present at the Site. The underlying assumption for this extrapolation is that potential effects on one representative species are consistent with the effects on similar species and representative of the potential for effects on the particular ecosystem being investigated. Thus, for the aquatic risk assessment, the Region 4 toxicity values for sensitive freshwater species were chosen to represent the potential for adverse chemical effects on the aquatic ecosystem. The selection of these species as representative indicators of the ecosystems presented in this SLERA is a major source of uncertainty for both the aquatic and terrestrial analyses.

It is difficult to predict how an adverse effect on an individual organism might affect the ecosystem as a whole. If adverse effects are predicted for an individual, it does not necessarily mean that the population, community, or ecosystem will be similarly affected. Even if one subset of the ecosystem is impacted in a localized area, such effects may no result in a perceptible impact to the overall ecosystem (e.g., loss of individual fish may not affect resident population).

Consistent with Region 4 guidance for conducting a SLERA, concentrations of constituents in background media were not considered in the selection of SLCOPCs. The ambient concentrations of many constituents are elevated compared to Region 4 screening values. Some constituents may be elevated due to naturally occurring conditions or non-site related activities. In addition, the potential effect of background concentrations of SLCOPCs arising from other sources may affect local populations. Also consistent with Region 4 guidance, the maximum detected concentration (or the maximum SQL for non-detected constituents) was selected as the EPC. Although this conservatively represents a worst-case scenario, it is highly unlikely that organisms or communities of organisms would be exposed to the absolute maximum of any constituent for the duration of their lifetimes. Even relatively sessile organisms, such as terrestrial invertebrates, will move during its lifetime and, given the heterogeneous nature of the concentrations of constituents in surficial media, is not likely be exposed exclusively to any particular concentration of SLCOPCs.

The data collected and used in the SLERA, and Region 4 SLERA guidance, do not consider the potential bioavailability of the SLCOPCs. For instance, the surface water data collected from the Wayman Street Ditch and Highland Street Ponds reflect the total recoverable fraction of the inorganic SLCOPCs. However, USEPA (1995) recognizes that the dissolved fraction of many metals should be used for analysis of data, since this fraction is the bioavailable and therefore potentially toxic fraction of the metal in surface water. There are also many potential binding phases for inorganic and organic constituents in surface soil, sediment, and surface water that may limit bioavailability. For instance, the USEPA (1993) equilibrium partitioning theory indicates that organic carbon will bind and limit or eliminate the bioavailability of nonpolar organic constituents. The presence of acid-labile sulfide may bind and limit the bioavailability of several heavy metals in sediment. USEPA currently has draft Equilibrium Sediment Guidelines (ESGs) for determining the bioavailable fraction of constituents in sediment in the presence of organic carbon and/or sulfide.

Lastly, in accordance with Region 4 guidance, non-detected constituents with no Region 4 screening values were retained as SLCOPCs. This approach adds considerable uncertainty to the SLERA approach and likely results in an overly conservative evaluation of potential risks to ecological receptors at the Landia Site, since there is no indication that these constituents are present at the Site (i.e., they were non-detected in the multiple rounds of sampling that have occurred at this Site during the past two decades).

8.0 Remedial Action Objectives

Remedial Action Objectives (RAOs) for the Landia Chemical Company site were developed based on a review of the results of the site sampling data, site-specific risk and fate and transport evaluations, and review of ARARs. The passage of Florida Statute Chapter 376 in 2005, established risk management options for contaminated sites and cleanup target levels for impacted media. It established 1 X 10^{-6} as an ARAR for determining acceptable carcinogenic risk associated with impacted media and a requirement to attain a hazard index of 1 or less for noncarcinogens.

Past operations at the Site resulted in the contamination of surface soil, subsurface soil and groundwater. The primary COCs at the Site include pesticides, nitrates and some metals. As with many Superfund sites, the problems associated with the Landia Chemical Company site are complex. As a result, the Site was divided into two operable units in order to divide the work into manageable pieces. Operable Unit 1 (OU1) addresses the COCs present in soil and Operable Unit 2 (OU2) addresses the COCs present in the groundwater. The following RAOs were developed for this action to address all COCs in OU1 and provide an interim action for the COCs in OU2. The RAOs were developed to protect current and reasonably anticipated future land uses anticipated for the two on-site properties and properties to the east, west, and north of the Site (i.e., commercial and/or industrial uses). The cleanup goals developed to attain these RAO's are found in Section 12.2.4, Table 5.

OPERABLE UNIT 1 (Soil Contamination):

- Prevent direct contact with and/or ingestion of soil containing site-related COCs at concentrations above health-based action levels.
- Prevent or minimize future migration of COCs in soil to groundwater that would result in groundwater concentrations above drinking water standards.

OPERABLE UNIT 2 (Groundwater Contamination):

- Prevent direct contact and/or ingestion of groundwater containing site-related COCs at concentrations above health based drinking water standards.
- Prevent or minimize further migration of the contaminant plume by reducing the concentrations of groundwater contamination in the areas of highest site-related groundwater concentrations above drinking water standards.

9.0 Description of Alternatives

The purpose of this section is to briefly summarize the remedial alternatives that were evaluated in the FS for soil and groundwater at the Site.

9.1 Alternative S1: No Action

The no action alternative was developed as required by the NCP, the regulation implementing the Superfund law. It is used as a baseline for comparing other alternatives. Under this alternative, EPA would take no action to remedy any contaminated soil at the Site. The potential risks associated with the soil contamination would not be minimized by this action.

- Estimated construction costs: $0
- Estimated O&M costs: $0
- Total present worth cost: $0
- Estimated Annual O&M Cost: $0
- Estimated Present Worth Costs: $0

9.2 Alternative S2: Excavation with off-site disposal of soils

Alternative S2 consists of the following components:

- Excavation of soil exceeding cleanup goals;
- Transportation and off-site disposal of excavated soils;
- Backfill and grading; and
- Institutional controls

Under alternative S2 approximately 23,900 cubic yards of contaminated soil exceeding cleanup goals (Table 5) would be excavated, loaded, transported and disposed of at an appropriately permitted disposal facility. The estimated areas of the exceedances of remedial goals that would be excavated under alternative S2 are shown in Figure 6. The volume of impacted soil that would be excavated includes impacted soil under paved surfaces and some buildings on the Landia property. Excavated soil would be sampled and analyzed by the Toxicity Characteristic Leaching Procedure (TCLP) to determine if it is a Resource Conservation and Recovery Act (RCRA) characteristic hazardous waste, or by the methodology required by the disposal facility. Based on past response actions at the Site, it is anticipated that the results will show that it is not a hazardous waste. Any excavated soil and sediment with characteristics requiring it to be classified as RCRA hazardous waste will be treated pursuant to RCRA requirements (40 CFR 268) prior to disposal in an offsite Subtitle D landfill.

After excavation and disposal, confirmation samples would be taken to ensure the cleanup goals have been achieved and the excavated areas would then be backfilled and graded appropriately. Backfill material may be amended with lime or limestone to increase the buffering capacity of the soil. The depressed loading ramp on the Landia property would be perforated and backfilled to match the surrounding ground surface to prevent the ramp from collecting water.

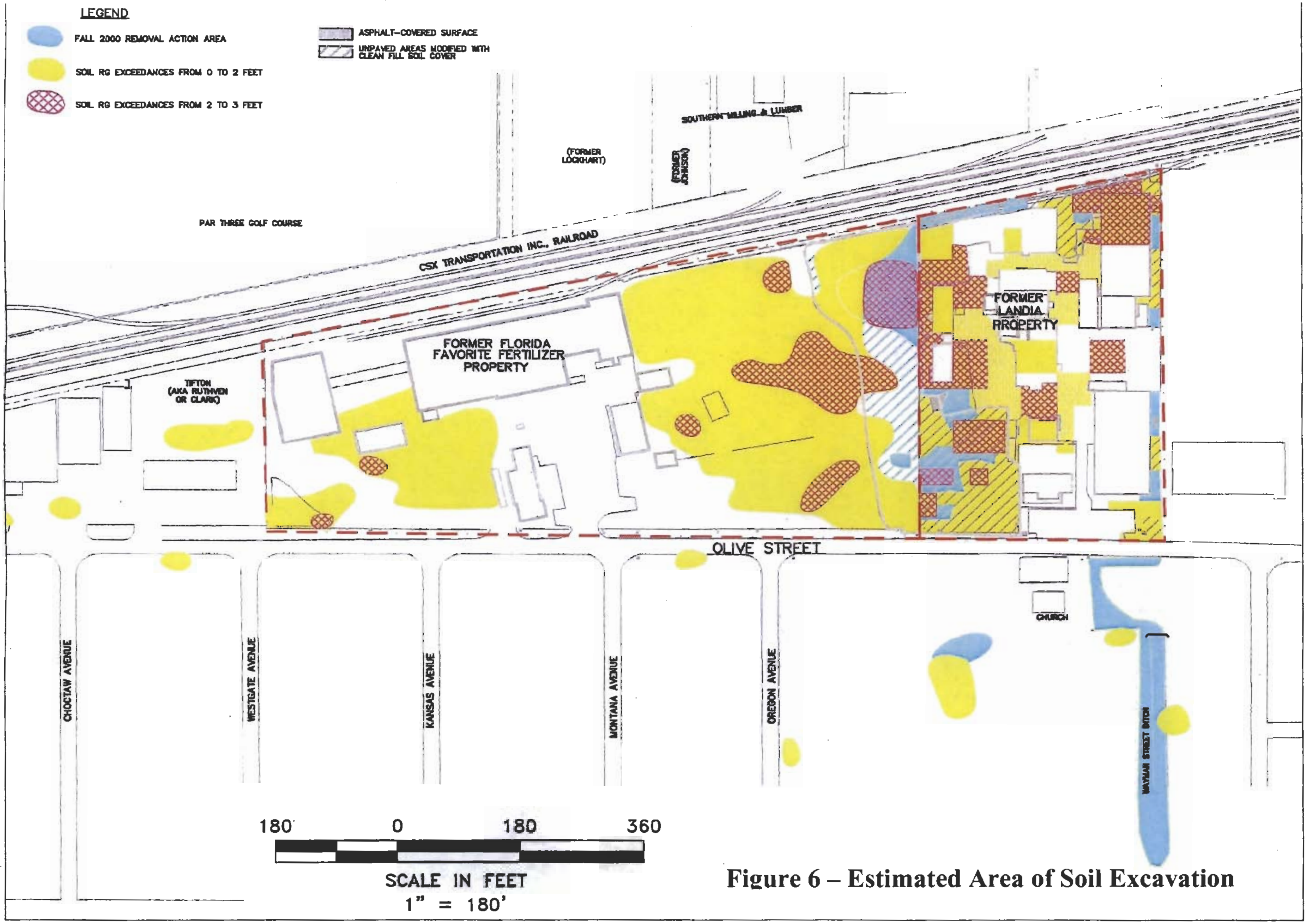


Figure 6 – Estimated Area of Soil Excavation

Institutional controls in the form of restrictive covenants would be placed on the Landia and former FFF properties to limit the future use of the properties to industrial and to limit future construction activities to prevent the potential exposure to any contaminated soil remaining under building foundations. Institutional controls would also include any relied upon engineered barriers (e.g. concrete slab, asphalt cap) to be maintained to prevent exposures to impacted soil.

It is anticipated that Alternative S2 would remove the direct exposure risks for commercial and industrial uses and minimize contaminants from migrating into the groundwater.

The costs associated with Alternative S2 are:

- Estimated construction costs: $4,021,400
- Estimated O&M costs: $0
- Total present worth cost: $4,021,400 (using a discount rate of 7%)
- Estimated Construction Timeframe: 6 months
- Estimated Time to Achieve RAOs: 6 months

9.3 Alternative S3: Excavation with partial off-site disposal of soils and partial on-site consolidation and capping

Alternative S3 consists of the following components:

- Excavation of all soil exceeding cleanup goals noted in Table 5;
- Transportation and off-site disposal of soil exceeding site-specific leachability based cleanup levels;
- On-site consolidation of soils below site-specific leachability based cleanup levels;
- Engineered capping of consolidated areas; and
- Institutional controls.

Under alternative S3 approximately 23,900 cubic yards of contaminated soil exceeding cleanup goals noted in Table 5 would be excavated as in alternative S2. The volume of impacted soil that would be excavated includes impacted soil under paved surfaces and some buildings on the Landia property. The estimated areas of the exceedances of remedial goals that would be excavated under alternative S2 are shown in Figure 6.

An estimated 19,690 cubic yards of soil which exceeded leachabilty cleanup goals noted in Table 5 would be excavated, loaded, transported and disposed of at an appropriately permitted disposal facility. This soil would be sampled and analyzed by the Toxicity Characteristic Leaching Procedure (TCLP) to determine if it is a Resource Conservation and Recovery Act (RCRA) characteristic hazardous waste, or by the methodology required by the disposal facility. Based on past response actions at this Site, it is anticipated that the results will show that it is not a hazardous waste. Any excavated soil and sediment with characteristics requiring it to be classified as RCRA hazardous waste will be treated pursuant to RCRA requirements (40 CFR 268) prior to disposal in an offsite Subtitle D landfill. The approximately 3,600 cubic yards of soil which met the site specific leaching cleanup goals but exceed the default direct exposure cleanup goals noted in Table 5 would be excavated, transported to and consolidated on the FFF property and compacted to construct an engineered cap. This alternative also includes perforating and backfilling the depressed loading ramp on the Landia property to prevent the ramp from filling with water.

After excavation was completed, confirmation samples would be taken to ensure the cleanup goals were achieved. The excavated areas would then be backfilled and graded appropriately. Backfill material may be amended with lime or limestone to increase the buffering capacity of the soil. The depressed loading ramp on the Landia property would be perforated and backfilled to match the surrounding ground surface to prevent the ramp from collecting water.

Institutional controls in the form of restrictive covenants would be placed on the Landia and former FFF properties to limit the future use of the properties to industrial and to limit future construction activities to prevent the potential exposure to any contaminated soil remaining under building foundations. Institutional controls would also require regular inspection of the engineered cap any other relied upon engineered barriers (e.g. concrete slabs, asphalt caps) to be maintained to prevent exposures to impacted soil.

It is anticipated that Alternative S3 would remove the contaminants of concern that exceed the site-specific leaching cleanup goals and minimize contaminants from migrating into the groundwater. Soils exceeding the default direct exposure cleanup levels (industrial and residential) would remain on-site under an engineered cap to prevent the potential for direct exposure.

The costs associated with Alternative S3 are:

- Estimated construction costs: $4,861,000
- Estimated O&M costs: $0
- Total present worth cost: $4,861,000 (using a discount rate of 7%)
- Estimated Construction Timeframe: 9 months
- Estimated Time to Achieve RAOs: 9 months

9.4 Groundwater Interim Action: In-Situ Treatment of Groundwater Using Chemical Oxidation of Areas with Elevated Levels of Pesticide Groundwater Contamination and Bioremediation of Elevated Residuals above NADCs.

The Groundwater Interim Action alternative consists of the following components:

- Installation of injection wells;
- Chemical oxidation injections in source area;
- In-situ bioremediation injections selected areas;
- Development of a performance monitoring plan to monitor and evaluate the effectiveness of the interim action; and
- Institutional controls;

Many studies have been conducted at the Landia Chemical site to determine groundwater conditions and evaluate potential remedial actions. These include a pH Adjustment Pilot Test in 2003, a Biogeochemical Evaluation in 2003-2004, a Chemical Oxidation Treatability Evaluation in 2004, and additional groundwater sampling in 2004 and 2006. While these studies have yielded much information about the contaminated groundwater and what treatment technologies may be effective, they do not provide enough information to select all the components of a final, site-wide remedy for groundwater. Therefore, an interim action was developed to address the most contaminated areas of groundwater combined with continued data collection in the areas of lower contamination. After the effectiveness of this interim action has been evaluated and more historical trends developed, another proposed plan and ROD would be issued selecting the final site-wide groundwater remedy.

Generally, groundwater contaminant concentrations are highest north of Olive Street underneath the industrial properties. In order to accomplish the goal of treating the most contaminated groundwater, the interim action would be implemented to treat all contaminated groundwater north of Olive Street which exceeds the Florida Natural Attenuation Default Criteria (NADCs) as shown in Figure 7. Treating all contaminated groundwater north of Olive Street above NADCs combined with one of the evaluated soil remedies is expected to have a beneficial impact on groundwater contaminant concentrations. The interim action would use in-situ chemical oxidation (injection of an oxidant to treat the targeted pesticide contaminants in the groundwater) to address areas with elevated levels of pesticide groundwater contamination selected during the remedial design and in-situ bioremediation (injections to enhance biologically assisted degradation) in all other areas in order to reduce contaminant concentrations to below the NADCs.

The injection process would involve installation of closely spaced injection wells. The required oxidants would be injected in 3 injection events. Following chemical oxidation, a polishing treatment may be required to address residual COCs and some of the oxidized metals. If required, this treatment would include injections to enhance biologically assisted degradation (in-situ bioremediation) which would use the injection wells installed for chemical oxidation. It is assumed that in-situ bioremediation would be implemented for approximately 2 years following chemical oxidation.

The available groundwater data indicate areas with elevated nitrate levels on the former FFF property in the vicinity of the storage and blending operations. In-situ bioremediation would be employed by creating anaerobic conditions in the aquifer to reduce the nitrates to nitrites and finally to nitrogen (denitrification). Nitrate reduction will be accomplished with periodic injections of carbohydrates using a direct push rig in the areas with elevated nitrate levels on the FFF property.

The active treatment of these source areas should further reduce the contaminant concentrations of less-impacted areas of groundwater located downgradient. Groundwater monitoring will be conducted to determine the effectiveness of the soil removal and the interim groundwater action (in-situ oxidation and bioremediation) in reducing contaminant concentrations and to support selection of the final groundwater remedy. Evaluation of the monitoring data will be conducted by both EPA and DEP on a yearly basis and at the five-year review timeframe. The five year

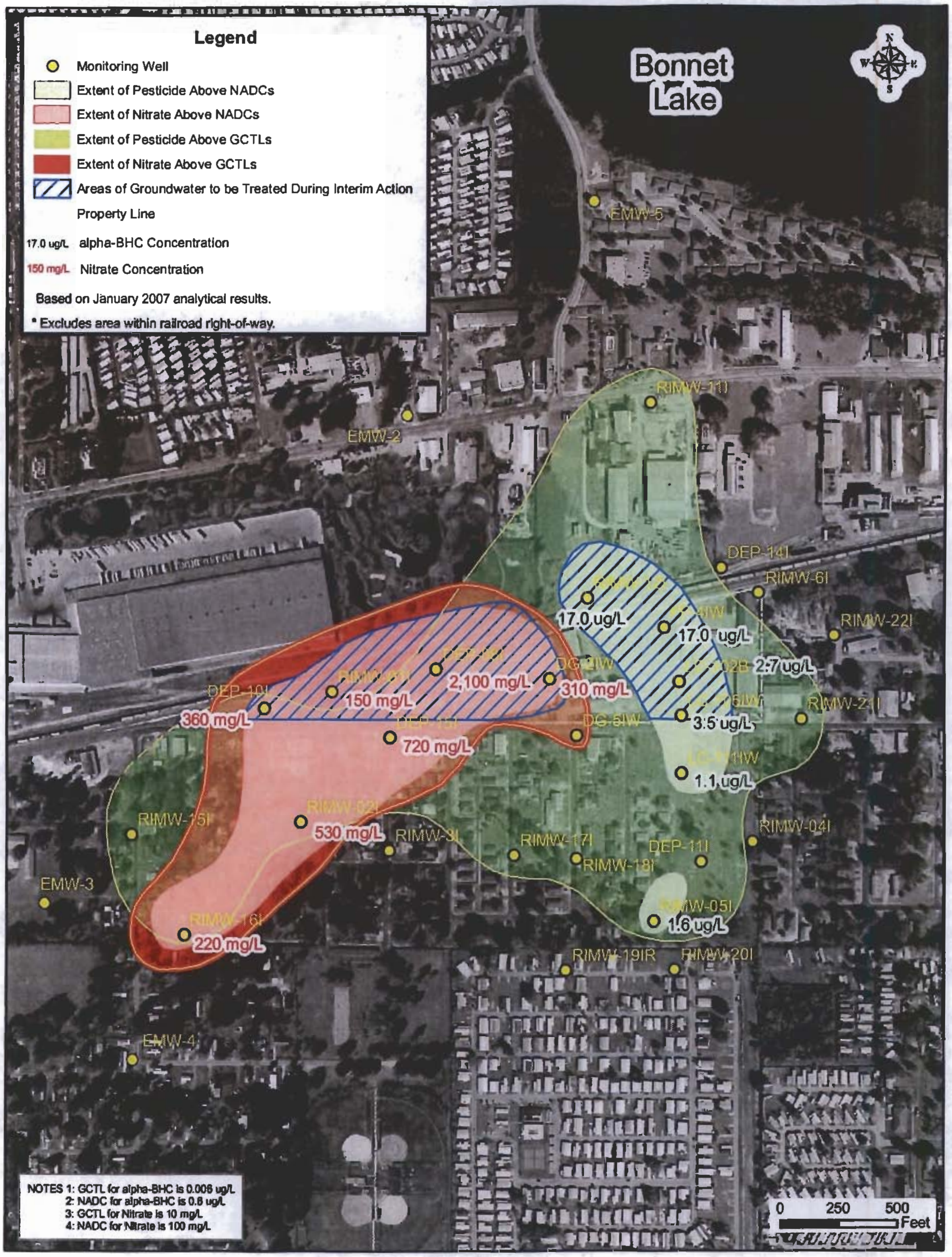


Figure 7 – Area of Groundwater Treatment

review period encompasses completion of the interim groundwater action and supporting groundwater pilot studies necessary for evaluation and selection of the final groundwater remedy.

Institutional controls will be used in order to ensure protectiveness during implementation of the interim groundwater remedy. Institutional controls are non-engineering instruments such as administrative or legal controls that eliminate or minimize the potential of human exposure to contaminants and chemicals of concern and to protect the integrity of the remedy by limiting land or resource utilization. The specific Institutional Controls for the Site will be established as part of the Remedial Design. During the Remedial Design, an Institutional Controls Implementation Plan will be developed to more clearly detail and describe the objective, mechanism, timing, and responsibility for the Institutional Controls to be implemented at the Site. The Institutional Controls will eliminate potential exposure at the Site property to the impacted soil and groundwater and to the impacted groundwater at other properties.

Institutional controls in the form of restrictive covenants would be placed on the former FFF and Landia properties by the site owners to limit future use of the properties to commercial/industrial and to restrict use of the groundwater until groundwater cleanup standards have been reached. The restrictive covenants may also require certain engineered controls (such as asphalt caps or concrete slabs) to be maintained to prevent potential future exposure to impacted soils underneath. Construction activities may be limited on these two properties to prevent exposure of impacted soils remaining under building foundations or require that the activities be conducted with FDEP approval.

Institutional controls may be used as the principal tool for preventing human exposure to contaminated groundwater at and downgradient of the Site. Maintenance of institutional controls is an essential component of the selected remedy and is necessary to prevent future risk resulting from consumption of contaminated groundwater. In order to ensure protectiveness during implementation of the interim groundwater remedy, access to impacted groundwater beneath and surrounding the Site will be restricted. A primary groundwater Institutional Control will be strict prohibition of drilling of wells and use of impacted groundwater in the area. Institutional Controls for impacted groundwater may include reliance on existing authorities of the FDEP, the South Water Florida Water Management District (SWFWMD), and various local government authorities. At a minimum, the Institutional Controls may include:

- In 1999, the Florida Department of Health (FDOH) conducted a Public Health Assessment and issued a Contaminated Groundwater Advisory for the residential area south of the Site. In the Public Health Assessment, FDOH requested that the Southwest Florida Water Management District (SWFWMD), the agency responsible for issuing permits for the construction of all new wells in the area, restrict permits for new well construction near the area of groundwater contamination.

- Florida Administrative Code 64E-8.003 contains requirements for the construction of any new private potable wells in Florida. It requires all new private potable wells to be separated from major contaminant sources. It also requires the groundwater be analyzed for contaminants if the wells are proposed to be constructed within 1000 feet of a known contaminant source.

- Florida Administrative Code 40D-3.305 confers to the SWFWMD the authority to deny a permit application to construct a water well if use of the well would increase the potential for harm to public health safety and welfare, or if the proposed well would degrade the water quality of the aquifer by causing pollutants to spread. EPA plans to notify SWFWMD of the area of impacted groundwater so that no wells will be allowed in the area unless it complies with SWFWMD requirements. EPA will periodically provide updates on the groundwater contaminant levels to the SWFWMD at least every five years or if contaminant concentrations show significant change.

- Public notice to area residents and businesses of the impacted groundwater every five years using the procedure as set forth in Florida Administrative Code 62.780.220(3).
- An inventory of area wells every five years to ensure that no new well have been installed that would expose area residents or businesses to impacted groundwater.

These regulations, advisories and restrictions prevent potential future exposure to contaminated groundwater on or surrounding the Site until the cleanup standards have been achieved.

The following are estimated costs for implementing the Groundwater Interim Action (using a 7% discount rate):

- Estimated design and predesign costs: $248,500
- Estimated Present Worth Costs (Year 1): $2,551,200
- Estimated Present Worth Costs (Year 2): $874,700
- Estimated Present Worth Costs (Year 3): $808,400
- Estimated Construction Timeframe: 1 year
- Estimated Time to Achieve RAOs: 20 years (for cost estimating purposes)

10.0 Summary of Comparative Analysis of Alternatives

The alternatives were evaluated against one another by using the following nine criteria:

- Overall protection of human health and the environment;
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs);
- Long term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume through treatment;
- Short term effectiveness;
- Implementability;
- Costs;
- State acceptance; and
- Community acceptance.

The NCP categorized the nine criteria into three groups:

- **Threshold criteria:** the first two criteria, overall protection of human health and the environment and compliance with ARARs (or invoking a waiver), are the minimum criteria that must be met in order for an alternative to be eligible for selection.
- **Primary balancing criteria:** the next five criteria are considered primary balancing criteria that are used to weigh major trade-offs among alternative cleanup methods.
- **Modifying criteria**: state and community acceptance are modifying criteria that are formally taken into account after public comment is received on the Proposed Plan. Community acceptance is addressed in the responsiveness summary of the ROD.

10.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

All of the soil alternatives are protective of human health and the environment with the exception of Alternative S1 as it does not involve an active remedy to reduce risk. If the source areas are not remediated, the potential exists for exposure to humans and the environment including continued leaching of COCs into the groundwater. Alternative S2 is most protective of human health and environment because nearly all of the source material will be removed from the Site. Alternative S3 is also protective because most of the COC mass will be removed and the remaining material will be below site-specific leaching SCTLs and will be capped to minimize the potential for exposure. However, the engineered cap would require long-term maintenance and monitoring. Accidental removal or deterioration of the cap may result in exposure to contaminated soils and would compromise the protection of human health and environment.

The groundwater interim action is expected to be protective of human health and the environment in the short term due to the use of treatment technologies designed to reduce the toxicity, mobility and volume of the contaminants. Chemical oxidation is expected to significantly reduce pesticide concentrations in the source areas at the Site. In-situ bioremediation would also be used to address the on-site areas of groundwater contaminated with nitrates and treatment residuals from chemical oxidation. Institutional controls will be used to restrict the use of contaminated groundwater.

10.2 Compliance with ARARs

Section 121(d) of CERCLA and NCP §300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4).

Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site. To Be Considered (TBC) Criteria are non-promulgated advisories or guidance documents issued by federal or state governments. They do not have the status of ARARs but can be considered in determining the necessary level of cleanup for the protection of human health or the environment. Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statues or provides a basis for invoking a waiver.

Location-specific ARARs are restrictions placed on the concentration of hazardous substances to the conduct of activities solely on the basis of location. No location specific ARARs were identified at this Site.

Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy. EPA considers the applicable or relevant and appropriate provisions of the statutes, rules, regulations, and requirements contained in Table 3 as action specific ARARs.

Chemical-specific ARARs are specific numerical quantity restrictions on individually-listed contaminants in specific media. Examples of chemical-specific ARARs include drinking water standards and ambient air quality standards. Because there are usually numerous contaminants of potential concern for any remedial site, various numerical requirements can be ARARs. In most cases for this remedy, EPA has chosen to incorporate FDEP SCTLs (Soil Cleanup Target Levels) and GCTLs (Groundwater Cleanup Target Levels) found in Florida Chapter 62-777 F.A.C. to satisfy the ARAR of attaining a 1×10^{-6} risk level for carcinogens and a hazard index of 1 or less for noncarcinogens (Florida Statute Chapter 376) when they existed for Site COCs, where they were developed based on health based criteria, and were derived using currently accepted risk assessment assumptions and processes utilized by the CERCLA program. EPA considers the applicable or relevant and appropriate provisions of the statutes, rules, regulations, and requirements contained in Table 4 as chemical specific ARARs.

Table 3 - Action-Specific ARARs			
Requirement	Citation	Description	Comments
Construction Standards	29 CFR 1929	Establishes occupational safety and health standards for the construction industry	Applicable for remedial actions involving construction and excavation to certain depths.
Occupational Safety and Health Administration Regulations	29 CFR Parts 1904, 1910, and 1926	Occupational safety and health requirements applicable to workers engaged in onsite work during implementation of remedial actions	Applicable to soil and groundwater remedial actions.
Hazardous Waste Operations and Emergency Response	29 CFR 1910	Defines health and safety procedures necessary during remedial investigations and cleanup	Applicable. All proposed site activities need to provide an adequate level of worker protection.
Identification and listing of hazardous waste	40 CFR 261 et. seq.)	Defines those solid wastes that are subject to regulation as hazardous wastes under 40 CFR 262-265, and 124, 127, and 271	Applicable if hazardous wastes are generated on site as a result of cleanup activities.

Table 3 - Action-Specific ARARs

Requirement	Citation	Description	Comments
Standards applicable to generators of hazardous waste	40 CFR 262	Establishes standards for generators of hazardous waste that address waste accumulation, preparation for shipment and completion of the uniform hazardous waste manifest.	Applicable if remedial actions involve generation of hazardous waste.
Standards applicable to owners/operators of hazardous waste treatment, storage, and disposal facilities	40 CFR 264	Establishes minimum national standards that define the acceptable management of hazardous waste for owners and operators of facilities that treat, store, or dispose of hazardous waste.	Relevant and appropriate if remedial actions involving on-site ex-situ treatment methods for hazardous waste.
Land Disposal Restrictions	40 CFR 268	Prohibits land disposal of specified untreated hazardous wastes and provides special requirements for handling such wastes.	Land disposal treatment requirements are applicable for disposal of hazardous waste/soils on-site disposal facility.
Hazardous Materials Transportation Act; Hazardous Material Transportation Regulations	44 USC 1801-1813; 40 CFR 107-171-177	Regulates transportation of hazardous materials	Applicable for offsite transportation of hazardous materials/soils.

Table 4 - Chemical-Specific ARARs			
Requirement	Citation	Description	Comments
Safe Drinking Water Act: National Primary Drinking Water Standards	40 CFR 141	Establishes health-based standards for public water systems (maximum contaminant level goals (MCLGs) and maximum contaminant levels (MCLs).	Applicable to potential drinking water sources.
Resource Conservation and Recovery Act (RCRA)	40 CFR 268	Establishes treatment standards based on best demonstrated available technology for treatment of hazardous wastes.	May be applicable to off-site treatment of impacted soils.
RCRA Toxicity Characteristic Rule	40 CFR 261	Establishes levels of chemicals which would harm human health or the environment if the waste was mismanaged.	Applicable to characterizing soils exceeding TCLP criteria.
Clean Air Act: National Primary and Secondary Ambient Air Quality Standards (NAAQS)	40 CFR 50	Establishes standards for ambient air quality to protect public health and welfare.	May be relevant and appropriate during a remedial action (e.g., soil excavation and particulate entrainment in wind & thermal destruction).
Clean Air Act: National Emissions Standards for Hazardous Air Pollutants (NESHAP)	40 CFR 61	Sets emission standards for pollutants for which no Ambient Air Quality Standards exist.	May be relevant & appropriate if hazardous air pollutant are emitted during a remedial action.

Table 4 - Chemical-Specific ARARs

Requirement	Citation	Description	Comments
Federal Water Pollution Control Act: USEPA Ambient Water Quality Criteria (AWQC)	33 USC A26; 40 CFR 131	Objectives are to restore and maintain the chemical, physical, and biological integrity of the nation's waters.	May be relevant and appropriate when modified to reflect the designated or potential use of the affected waters, the media affected, and the purpose of the criteria.
Contaminated Site Cleanup Criteria	Florida Statute Chapter 376.3071(g)(1)-(3) for groundwater and (i)(1)-(3) for soil.	Requires cleanups of contaminated soil and groundwater in the State of Florida to reduce the excess lifetime cancer risk to 1×10^{-6} for carcinogens and a hazard index of 1 or less for noncarcinogens.	Applicable.
FDEP Drinking Water Standards	F.A.C. Chapter 62-550	Establishes MCLs for contaminants in public water systems.	Applicable.
Florida Surface Water Quality Standards	F.A.C. Chapter 62-302	Establishes standards of quality for all surface waters in the state. Also, allows for site-specific alternative criteria for water bodies that may not meet a particular ambient water quality criterion applicable to the classification of the water body due	Applicable.

Table 4 - Chemical-Specific ARARs						
Requirement		Citation		Description		Comments
Regulation of Wells		Chapter 40D-3		Southwest Florida Water Management District (SWFWMD) rules govern the construction of water wells.		Applicable for construction of monitoring wells
Air Pollution Control - General Provision		F.A.C. Chapter 62-204		Establishes maximum allowable levels of pollutants in the ambient air, or ambient air quality standards, necessary to protect human health and public welfare.		May be relevant and appropriate during a remedial action (e.g., soil excavation and particulate entrainment in wind, thermal destruction).

All alternatives, except the no-action alternatives, had common ARARs associated with the soil and ground-water remediation goals. All soil alternatives are expected to meet ARARs with the exception of Alternative S1. Alternatives S2 and S3 are expected to comply with chemical specific ARARs as long as proper procedures are followed. These ARARs include compliance with industrial/leaching or residential cleanup goals, OSHA regulations for PPE, DOT regulations for transportation of impacted soil, CERCLA and RCRA requirements for disposal of impacted soil, OSHA requirements of excavation, FDEP and county erosion and sedimentation control requirements and air quality/emission requirements.

The groundwater interim action is expected to substantially reduce groundwater contaminant concentrations but is not expected to achieve drinking water standards. After evaluation of the effectiveness of the interim action, a final action will be chosen that meets all ARARs.

10.3 Long Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to the expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup levels have been met. This criterion includes the consideration of residual risk that will remain on-site following remediation and the adequacy and reliability of controls.

Each alternative, except the No Action alternative provides some degree of long term protection. Alternatives S2 and S3 would be effective upon completion of construction activities. The long term effectiveness of alternative S2 is greatest because the source material would be removed and disposed of off-site at a permitted facility. While alternative S3 does provide significant long term effectiveness, some residual risk would exist due to consolidation and capping of untreated soils that meet the site-specific leaching cleanup goals but do not meet the direct exposure cleanup goals. Both alternatives S2 and S3 would require some level of controls or long-term management as some isolated spots of contaminated soils that are under building footings/foundations and an engineered cap, respectively, would not be removed. However, Alternative S3 is less permanent due to consolidation of impacted soils under an engineered cap at the FFF property.

Among all the alternatives, Alternative S2 appears to have the greatest long term effectiveness and permanence.

The groundwater interim action is expected to enhance the long term effectiveness of the final groundwater remedy due to the active treatment of groundwater in areas demonstrating the most significant contaminant concentrations. Chemical oxidation and in-situ bioremediation technologies have been successfully used for the remediation of organic and inorganic constituents. Due to active treatment, the duration of the final groundwater remedy is expected to be shorter. Long-term monitoring programs and Five-Year Reviews will be required to evaluate the effectiveness and protectiveness of the groundwater interim action. Institutional controls (e.g., restrictive covenants and groundwater use restrictions) would be implemented until groundwater cleanup goals are met.

10.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of the remedy.

Alternative S1 has no impact on reduction in toxicity, mobility, or volume other than that reduced by natural processes. Alternatives S2 and S3 reduce the toxicity, mobility and volume of impacted soil at the Site. Any excavated soil and sediment with characteristics requiring it to be classified as RCRA hazardous waste will be treated pursuant to RCRA requirements (40 CFR 268) prior to disposal in an offsite Subtitle D landfill. Alternative S2 results in essentially complete removal of the impacted soil above industrial criteria from the Site and disposal at an off-site facility. Since the soils in this alternative will be disposed of at a permitted facility (e.g., Subtitle D landfill), the mobility is expected to be reduced by the implementation of proper control measures at that facility.

Although mobility will be reduced in Alternative S3 due to the same reasons as for Alternative S2, some reduction in mobility is also offered by capping.

The groundwater interim action offers a reduction of toxicity, mobility and volume with treatment of the contaminants in the areas of most significant groundwater impacts via chemical oxidation and in-situ bioremediation.

10.5 Short Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community and the environment during construction and operation of the remedy until construction of remedial components is completed and cleanup levels are achieved.

Alternative S1 requires no intrusive work, but is not an effective remedy. Risk to workers during implementation of Alternatives S2 and S3 include exposure to source material. However, this risk would be minimized by the use of proper health and safety procedures. Engineering controls (dust suppression and erosion control) would significantly minimize exposure to contaminants and would be protective to the community. These controls would be required for Alternatives S2 and S3. Alternatives S2 and S3 are expected to have some impact on the community. The generation of dust from excavation and backfilling and increased risk of accidents would be due to increased truck traffic. There is the possibility of a release of contaminants to the environment as a result of potential traffic accidents involving a haul truck. This is not a common occurrence and the magnitude of impact should be low based on experience gained during the 2000 removal action. Construction activities for Alternative S2 and S3 are expected to be completed in 6 months and 9 months respectively, with Alternative S3 taking slightly longer for construction of the cap.

The groundwater interim action requires the installation of groundwater monitoring and/or injection wells, which may pose a risk of exposure to impacted soil and groundwater by workers and the community. The potential risk of exposure to the local community from groundwater usage during implementation of the interim action would be minimized or eliminated through institutional controls. The interim action involves the installation of injection wells, reagent tanks, and delivery systems, in addition to monitoring wells. The risk of exposure to chemicals and impacted groundwater for workers exists for the groundwater interim action, including the risks posed by the exothermic reaction during chemical oxidation. These risks would be reduced through implementation of proper procedures and the use of appropriate health and safety measures. These risks would not be present to the general public since the interim action would be conducted in on-site areas that are fenced and locked.

10.6 Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other government entities are also considered.

Alternative S1 is readily implementable because no construction activity is required. Alternatives S2 and S3 are easily implementable. The excavation components of these alternatives can be implemented using standard construction equipment and techniques and have been demonstrated effective at the facility during previous removal actions. Alternative S3 includes the construction of an engineered cap, which also uses standard engineering and construction methods.

The groundwater interim action is labor intensive due to the processes of chemical oxidation and in-situ bioremediation, but is easily implementable. The installation of injection wells and the process for chemical injection and in-situ bioremediation can be implemented using standard construction equipment and techniques.

The institutional control components of all remedies have been analyzed and determined to be implementable. Institutional controls associated with the groundwater remedy would require the cooperation of the State and Local governments. The Florida Administrative Code has been reviewed to determine responsibilities and requirements for the installation of new private wells. The Southwest Florida Water Management District (SWFMD) has been informed about the groundwater contamination from the Site.

10.7 Costs

Cost estimates for each alternative were calculated based on conceptual engineering and design. The type of costs that were assessed included:

- capital costs, including both direct and indirect costs;
- annual O&M; and
- total present worth costs.

The present worth cost of each soil alternative provides the basis for the cost comparison. Total present worth cost was calculated by combining the capital cost plus the present worth of the annual O&M costs. Capital cost includes engineering and design, mobilization, site development, equipment, construction, demobilization, utilities, and sampling/analyses. Operating costs were calculated for activities that continue after completion of construction, such as routine operation and maintenance of treatment equipment, and groundwater monitoring. The present worth of an alternative is the amount of capital required to be deposited at the present time at a given interest rate to yield the total amount necessary to pay for initial construction costs and future expenditures, including O&M and future replacement of capital equipment. The total present worth cost was developed using a discount rate of 7 percent. Each of the soil alternatives should meet cleanup goals within one year. Present worth costs needed to meet performance standards are within the range of +50% to -30% accuracy. If the total volume of materials to be excavated and disposed of change from current estimates, the cost estimate associated with these remedial components would change. Of the soil alternatives, Alternative S3 is the most expensive alternative. Alternative S2 is the least expensive option.

10.8 State Acceptance

The State of Florida, as represented by the FDEP, has been the support agency during the Remedial Investigation and Focused Feasibility Study (RI/FFS) process for the Landia Site. In accordance with 40 C.F.R. § 300.430, FDEP as the support agency, has provided input during this process by reviewing major documents in the Administrative Record. At this time, the FDEP concurs with the selected remedy.

10.9 Community Acceptance

EPA held a public meeting to discuss the proposed remedy on July 10, 2007. During the public comment period, the community generally supported the selection of Alternative S2. Specific responses to issues raised by the community can be found in Appendix A, The Responsiveness Summary.

11.0 Principal Threat Wastes

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP §300.430(a)(1)(iii)(A)). The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contaminants to ground water, surface water or air, or acts as a source for direct exposure. Contaminated ground water generally is not considered to be a source material. Principal threat wastes are those source materials considered highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur.

Most principal threat wastes that were originally present at the Site were removed during the previous removal actions. The remaining principal threat wastes are in the subsurface soil just above the water table. If not addressed, these remaining principal threat wastes would likely migrate into the groundwater at levels well above drinking water standards and significantly increase the amount of time needed to achieve cleanup standards. The remaining principal threat wastes will be addressed through excavation.

12.0 Summary of Selected Remedy

12.1 Summary of Rationale for the Selected Remedy

Based upon consideration of the requirements of CERCLA, the NCP, FDEP regulations, the detailed analysis of alternatives and public and state comments, EPA has selected Soil Alternative S2 as the final action for soil, an interim action to address groundwater contamination, and implementation of various institutional controls to ensure future protectiveness.

Soil Alternative S2 (excavation and offsite disposal) the selected final remedy to address soil contamination. Alternative S2 is more protective of human health and the environment compared to Alternatives S1 and S3. Its comparative advantage over the other soil alternatives is that the majority of the soils impacted above the cleanup goals in Table 5 will be removed from the Site thus allowing for substantive elimination of remaining source materials as well as relatively unrestricted industrial use (except for some impacted soils remaining under building footings/foundations) for the first year of implementation. Alternative S1 does not comply with ARARs and is thus not protective. Alternative S3 leaves impacted soils on Site and requires long-term care similar to a solid waste landfill. Alternative S3 significantly restricts use of a significant area of the former FFF property compared to Alternative S2. The present worth cost of Soil Alternative S2 is $4,021,400 which makes it also slightly less expensive than alternative S3.

EPA is selecting an interim action to address groundwater contamination. Many studies have been conducted at the Site to determine site groundwater conditions and evaluate potential groundwater remedial actions. These include a pH Adjustment Pilot Test in 2003, a Biogeochemical Evaluation in 2003-2004, a Chemical Oxidation Treatability Evaluation in 2004, and additional groundwater sampling in 2004 and 2006. While these studies have yielded much information about the contaminated groundwater and what treatment technologies may be effective, they do not provide enough information to select all the components of a final, site-wide remedy for groundwater. The interim action will treat the most contaminated groundwater via in-situ chemical oxidation and in-situ bioremediation and continued to collect samples in the areas of lower contamination. After the effectiveness of this interim action has been evaluated and more historical trends developed, another proposed plan and ROD will be issued selecting the final site-wide groundwater remedy.

In order to ensure future protectiveness, this ROD selects the implementation of various institutional controls. Institutional controls will be implemented to ensure the future use of the Landia and former FFF properties remain industrial, to restrict the use of contaminated groundwater, and to ensure any engineering barriers that are relied upon are maintained.

12.2 Description of the Selected Remedy

12.2.1 Selected Soil Remedy

12.2.1.1 Excavation of soils exceeding Cleanup Goals

The excavation and off-site disposal of soil alternative (S2) is designed to address the impacted shallow and subsurface soil which exceed the cleanup goals shown in Table 5. Alternative S2 involves the excavation of contaminated soil using mechanical equipment. Approximately 13,289 cubic yards (cy) of soil will be excavated on the former FFF parcel, an estimated 7,980 cy of soil will be excavated on the Landia property and an estimated 2,021 cy of soil and sediments will be excavated from localized areas south of Olive Street for an estimated total of 23,290 cubic yards of excavated soil. The volume of contaminated soil to be excavated includes the contaminated soil estimated to be under paved surfaces at the Landia property. The actual limits of contamination will be determined during the remedial design phase, and during the remedial action through confirmation sampling to be conducted after excavation activities occur. In addition to collecting confirmation samples for attaining the cleanup goals in Table 5, confirmation samples will also be collected and evaluated for sulfur concentrations in the area of historical bulk sulfur storage to ensure most of the sulfur is removed. This should have a beneficial effect on raising the pH in the soil and shallow groundwater. The depressed loading ramp on the Landia property will be perforated and backfilled to match the surrounding ground surface to prevent the ramp from collecting water. Engineering measures such as dewatering of excavation areas may be required to allow excavation work to proceed. Any water removed would be contained, analyzed, treated if necessary and properly disposed.

12.2.1.2 Transportation and off-site disposal of excavated soils

Once the soil is excavated and stockpiled, confirmation samples will be collected to verify that the remaining soils meet proposed soil cleanup goals found in Table 5. In addition, the stockpiled material will be characterized for disposal at an appropriate permitted off-site disposal facility. Excavated soil would be sampled and analyzed to determine if it is a RCRA characteristic hazardous waste. Based on past response actions, it is anticipated that the results will show that it is not a hazardous waste. Any excavated soils and sediments with characteristics requiring it to be classified as RCRA hazardous waste will be treated pursuant to RCRA requirements (40 CFR 268) prior to disposal in an offsite Subtitle D landfill. The stockpiled soil will be placed on and covered by plastic to prevent dispersion. The impacted soil is assumed to be non-hazardous soils based on the information from the 2000 Removal Action.

12.2.1.3 Backfill and grading

After removal and disposal, the excavated areas will be backfilled and graded appropriately for proper site drainage. The backfill may be amended with lime or limestone in some areas to increase the buffering capacity of the soil. At a minimum, backfill will be sampled to ensure it meets the cleanup goals found in Table 5.

12.2.2 Interim Action for Groundwater

Generally, groundwater contaminant concentrations are highest north of Olive Street underneath the industrial properties. In order to accomplish the goal of treating the most contaminated groundwater, the interim action will be implemented to treat all contaminated groundwater north of Olive Street which exceeds the Florida Natural Attenuation Default Criteria (NADCs). Treating all contaminated groundwater north of Olive Street above NADCs combined with one of the evaluated soil remedies is expected to have a beneficial impact on groundwater contaminant concentrations. The interim action will use in-situ chemical oxidation to address areas with elevated levels of pesticide groundwater contamination selected during the remedial design and in-situ bioremediation in all other areas of the treatment area in order to reduce contaminant concentrations to below the NADCs. The active treatment of these source areas should further reduce the contaminant concentrations of less-impacted areas of groundwater located downgradient. Groundwater monitoring will be conducted to determine the effectiveness of the soil removal and the interim groundwater action (in-situ oxidation and bioremediation) in reducing contaminant concentrations and to support selection of the final groundwater remedy.

12.2.2.1 Chemical oxidation injections in source area

In-situ chemical oxidation will be implemented to address areas with elevated levels of pesticide groundwater contamination within the treatment area. These areas with elevated levels of pesticide groundwater contamination will be selected during the remedial design. Chemical oxidation is an in-situ remedial treatment process that can be used to oxidize organic compounds to carbon dioxide, water and salts. The chemical oxidation treatability study indicated that an oxidizing reagent was effective in reducing the concentrations of BHCs and SVOCs in the groundwater samples. The reagent would be injected into the contaminated subsurface to produce hydroxyl radicals that attack and oxidize chlorinated pesticides, SVOCs, and non-chlorinated organics (e.g., ethyl benzene and total xylenes). During the oxidation process, some metals naturally occurring in groundwater may be oxidized as well; however, in low pH areas, metal oxidation has likely already occurred.

Presence of high organic carbon and inorganic species in soil and groundwater can act as oxidant sinks. Therefore, a field pilot study will be conducted during the remedial design to estimate the oxidant requirements, to determine the area to be treated via chemical oxidation, and to evaluate effectiveness of the treatment process prior to full-scale implementation.

The injection process involves installation of closely spaced injection wells. For the purpose of costing, the areas with elevated levels of pesticide groundwater contamination to be treated include approximately 20,000 square feet (sf) of area near the former sulfur pile (near wells FF-4R and FF4-IW) and 14,000 sf of area near the northern Landia property (near well LC112 IW). The required oxidants will be injected in three (3) injection events over approximately one year.

Following chemical oxidation, a polishing treatment may be required to address residual COCs and some of the oxidized metals. If required, this treatment would include injections to enhance biologically assisted degradation (in-situ bioremediation) which would use the injection wells installed for chemical oxidation

12.2.2.2 In-situ bioremediation injections

Following chemical oxidation, in-situ bioremediation will be used to address areas of pesticide contamination adjacent to the areas with elevated levels of pesticide groundwater contamination. This step will assist in reducing the majority of the oxidized heavy metals (e.g., chromium) and allow them to precipitate in-situ. This treatment will use the injection wells installed for oxidation for injections to enhance biologically assisted degradation (in-situ bioremediation). It is assumed that in-situ bioremediation will be implemented for approximately 2 years following chemical oxidation.

The RI data indicate there are areas with elevated nitrate levels on the FFF property in the vicinity of the storage and blending operations. Theses areas will be refined if necessary during the remedial design. In-situ bioremediation will be employed by creating anaerobic conditions in the aquifer (through enhanced in-situ bioremediation) to reduce the nitrates to nitrites and finally to nitrogen (denitrification). Nitrate reduction will be accomplished with periodic injections of carbohydrates using a direct push rig in the areas of elevated nitrate levels on the FFF property. For the purpose of costing, it was estimated that carbohydrate solution would be injected at approximately 50 locations using a direct push rig on a quarterly basis for approximately 2 years.

12.2.2.3 Performance Monitoring Plan

Groundwater monitoring will be conducted to determine the effectiveness of the soil removal and the interim groundwater action (in-situ oxidation and bioremediation) in reducing contaminant concentrations and to support selection of the final groundwater remedy. Groundwater monitoring of 31 monitoring wells is occurring at the Site consistent with the approved groundwater monitoring plan dated February 2006. Sampling includes collection of water levels; analysis for pesticides, volatile organic compounds, semi-volatile organic compounds, metals, sulfates, and nitrates; and collection of various water quality parameters including dissolved oxygen, pH, temperature, conductivity, oxygen reduction potential, and turbidity. A baseline groundwater monitoring event occurred in October 2006 and the first quarterly sampling even occurred in January 2007. Quarterly sampling will continue for one year and then it is anticipated that sampling will continue on a semi-annual basis. The focus of the groundwater monitoring will continue to be to evaluate plume stability and behavior but will also evaluate the effectiveness of the soil remedy and groundwater interim action and evaluate the attenuation of dissolved contaminants. A sufficient number of wells will continue to be monitored so that a comprehensive evaluation of the changing characteristics of the plume can be completed. The performance monitoring plan will also evaluate the occurrence of Monitored Natural Attenuation (MNA) consistent with EPA's guidelines for evaluating MNA.

Evaluation of the monitoring data will be conducted on a yearly basis and at the five-year review timeframe. It is anticipated that the first five year review will include an evaluation of the effectiveness of the interim groundwater action and supporting groundwater pilot studies necessary for evaluation and selection of the final groundwater remedy.

12.2.3 Institutional controls

Institutional controls are non-engineering instruments such as administrative or legal controls that eliminate or minimize the potential of human exposure to contaminants and chemicals of concern and to protect the integrity of the remedy by limiting land or resource utilization. The specific Institutional Controls for the Site will be established as part of the Remedial Design. During the Remedial Design, an Institutional Control Implementation Plan will be developed to more clearly detail and describe the objective, mechanism, timing, and responsibility for the Institutional Controls to be implemented at the Site. The Institutional Controls will eliminate potential exposure at the Site property to the impacted soil and groundwater and to the impacted groundwater at other properties.

Institutional controls in the form of restrictive covenants will be placed on the former FFF and Landia properties by the site owners to limit future use of the properties to commercial/industrial and to restrict use of the groundwater until groundwater cleanup standards have been reached. The restrictive covenants may also require certain engineered controls (such as asphalt caps or concrete slabs) to be maintained to prevent potential future exposure to impacted soils underneath. Construction activities may be limited on these two properties to prevent exposure of impacted soils remaining under building foundations or require that the activities be conducted with FDEP approval.

Institutional controls may be used as the principal tool for preventing human exposure to contaminated groundwater at and downgradient of the Site. Maintenance of institutional controls is an essential component of the selected remedy and is necessary to prevent future risk resulting from consumption of contaminated groundwater. In order to ensure protectiveness during implementation of the interim groundwater remedy, access to impacted groundwater beneath and surrounding the Site will be restricted. A primary groundwater Institutional Control will be strict prohibition of drilling of wells and use of impacted groundwater in the area. Institutional Controls for impacted groundwater may include reliance on existing authorities of the FDEP, the South Water Florida Water Management District (SWFWMD), and various local government authorities. At a minimum, the Institutional Controls may include:

- In 1999, the Florida Department of Health (FDOH) conducted a Public Health Assessment and issued a Contaminated Groundwater Advisory for the residential area south of the Site. In the Public Health Assessment, FDOH requested that the Southwest Florida Water Management District (SWFWMD), the agency responsible for issuing permits for the construction of all new wells in the area, restrict permits for new well construction near the area of groundwater contamination.

- Florida Administrative Code 64E-8.003 contains requirements for the construction of any new private potable wells in Florida. It requires all new private potable wells to be separated from major contaminant sources. It also requires the groundwater be analyzed for contaminants if the wells are proposed to be constructed within 1000 feet of a known contaminant source.

- Florida Administrative Code 40D-3.305 confers to the SWFWMD the authority to deny a permit application to construct a water well if use of the well would increase the potential for harm to public health safety and welfare, or if the proposed well would degrade the water quality of the aquifer by causing pollutants to spread. EPA plans to notify SWFWMD of the area of impacted groundwater so that no wells will be allowed in the area unless it complies with SWFWMD requirements. EPA will periodically provide updates on the groundwater contaminant levels to the SWFWMD at least every five years or if contaminant concentrations show significant change.

- Public notice to area residents and businesses of the impacted groundwater every five years utilizing the procedure as set forth in Florida Administrative Code 62.780.220(3).

- An inventory of area wells every five years to ensure that no new well have been installed that would expose area residents or businesses to impacted groundwater.

These regulations, advisories and restrictions prevent potential future exposure to contaminated groundwater on or surrounding the Site until the cleanup standards have been achieved.

12.2.4 Final Selected Cleanup Goals

The final selected cleanup goals for soil and groundwater are found in Table 5

TABLE 5
CLEANUP GOALS FOR SOIL AND GROUNDWATER

Chemicals of Concern (COC)	Offsite Soil Residential Area[1]	Onsite Soil Industrial Area	Basis	Groundwater Cleanup Standard	Basis
	mg/kg	mg/kg		ug/L	
1,2,4-Trichlorobenzene	-	-	-	70	MCL[2]
2,4-Dichlorophenol	-	-	-	20	Region 4 Health Based Cleanup Level[3]
2-Chlorophenol	-	-	-	35	GCTL[4]
4,4'-DDD	4.2	7	Site Specific SCTL[5]	0.1	GCTL
4,4'-DDE	-	15	Industrial SCTL[6]	0.1	GCTL
4,4'-DDT	2.9	11	Default Leaching SCTL[7]	0.1	GCTL
4-Nitrophenol	-	1.12	Site Specific SCTL	56	GCTL
Aldrin	0.06	0.3	Industrial SCTL	-	-
alpha-BHC	0.1	0.009	Site Specific SCTL	0.006	GCTL
alpha-Chlordane	2.8	14	Industrial SCTL	-	-
Arsenic	2.1	12	Industrial SCTL	10	MCL
beta-BHC	-	0.03	Site Specific SCTL	0.02	GCTL
Cadmium	-	17	Site Specific SCTL	5	MCL
Chlordane (technical)	2.8	14	Industrial SCTL	2	MCL
Chromium	-	38	Default Leaching SCTL	100	MCL
delta-BHC	-	25.6	Site Specific SCTL	2.1	GCTL
Dieldrin	0.06	0.04	Site Specific SCTL	0.002	GCTL
Dioxin (TEQ)	-	0.00003	Industrial SCTL	-	-
gamma-BHC (Lindane)	-	0.5	Site Specific SCTL	0.2	GCTL
Heptachlor	0.2	1	Industrial SCTL	-	-
Heptachlor epoxide	0.1	0.5	Industrial SCTL	-	-
Hexachlorobenzene	-	1.2	Industrial SCTL	-	-
Lead	400	1400	Industrial SCTL	15	MCL
Methylene chloride (Dichloromethane)	-	-	-	5	MCL
Nitrate	-	-	-	10,000	MCL
Nitrite	-	-	-	1,000	MCL
Toxaphene	0.9	4.5	Industrial SCTL	3	MCL
Xylenes (total)	-	156.4	Site Specific SCTL	3500	Region 4 Health Based Cleanup Level

* See Notes Next Page

Table 5 Notes:

(-) indicates that chemical was not identified as a chemical of concern in the associated media.

1. *Residential Soil Cleanup Target Levels (SCTLs) found in FAC 62-777. The residential SCTLs found in FAC 62-777 are derived in order to protect receptors from direct exposure to contaminants in soil in a residential scenario and to meet the 10-6 excess cancer risk ARAR contained in Chapter 376.3071(i)(1)-(3) and FAC 62-780.*

2. *Florida Maximum Contaminant Level (MCL) found in FAC 62-550.*

3. *Where the Florida GCTL was based on organoleptic or aesthetic values, EPA generated, health based values were used.*

4. *Florida Groundwater Cleanup Target Level (GCTL) found in FAC 62-777. The Florida GCTLs found in FAC 62-777 are derived in order to protect receptors from direct exposure to contaminants in groundwater and to meet the 10-6 excess cancer risk ARAR contained in Chapter 376.3071(g)(1)-(3) and FAC 62-780.*

5. *Site specific SCTL developed to reduce leaching of contaminants from soil to groundwater above GCTL..*

6. *Industrial Florida SCTL found in FAC 62-777. The industrial SCTLs found in FAC 62-777 are derived in order to protect receptors from direct exposure to contaminants in soil in an industrial worker scenario and to meet the 10-6 excess cancer risk ARAR contained in Chapter 376.3071(i)(1)-(3) and FAC 62-780.*

7. *Default Florida SCTL found in FAC 62-777 to protect against soil contaminants leaching into groundwater at concentrations above GCTLs.*

12.3 Summary of the Estimated Remedy Costs

The cost estimate is based on the best available information regarding the anticipated scope of the remedial alternatives. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternatives. Major changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost. The estimated total present worth cost for the soil alternative is $4,021,400 (Table 6). The estimated total present worth cost for the interim action for groundwater is $4,482,800 (Table 7). The estimated total cost to implement both the soil remedial alternative and the interim action for groundwater is $8,504,200.

All of the assumptions made, including the quantity of soil removed, the number of injection wells, the number of wells included in the performance monitoring plan and the frequency of sampling are based on the current data available at the Site. Actual costs to successfully implement these remedies may vary based on new pilot site data and/or changing Site conditions.

Table 6
Evaluation of Probable Costs for Excavation and Off-Site Disposal of Soils (Soil Alternative S2), Landia Site, Lakeland, Florida.

		Description	Notes	Unit	Qty	Unit Cost ($)	Total Cost
I. Design Services							
1		Project Management/Coordination	a/	ls	1	$3,100	$3,100
2		Contract Documents/Construction Plans/Specifications/HASP (excavation & SVE)		ls	1	$20,000	$20,000
3		Prebid meeting/contractor selection/contracting/planning		ls	1	$8,000	$8,000
		Subtotal Design Services Costs					$31,100
4		Contingency (20% of Design Services Costs)					$6,220
		Total Design Services Costs					$37,320
		Present Worth Design Services Costs (Year 1) (assumed to be disbursed in Year 1)	b/				**$34,900**
II. Construction Costs							
1		Excavation and Off-Site Disposal					
	a	Mobilization/Demobilization	c/	ls	1	$15,000	$15,000
	b	Site Clearing/Preparation/Decon/Staging Areas Setup/Erosion Control	c/	ls	1	$25,000	$25,000
	c	Excavation	d/	cy	23290	$10.00	$232,900
	d	Backfill (on-site soils)	e/	cy	1391	$3.50	$4,870
	e	Backfill (clean/imported soil)		cy	21899	$10	$218,990
	f	Load (soil)	f/	cy	21899	$3	$65,700
	g	Haul/Handling of Soils/Staging (on-site)	f/	cy	23290	$3	$69,870
	h	Silt Fence (sediment control)		lf	1500	$3.50	$5,250
	i	Equipment Decontamination	g/	ea	30	$250	$7,500
	j	Decon Water/IDW Transportation & Disposal (non-hazardous)	g/	Gal	2000	$1	$2,000
	k	Confirmation soil sampling/analysis	h/	ea	340	$270	$91,800
	l	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup		ls	1	$5,000	$5,000
	m	Site Survey/As-Builts		ls	1	$10,000	$10,000
	n	Fill NE loading ramp (Landia Property)		cy	208	$20	$4,160
	o	Building Demolition (Landia Property)		ls	1	$236,000	$236,000
	p	Contractor Overhead/Profit (20% of Total Costs less disposal)		ls	1	$150,800	$150,800
		Subtotal Excavation Costs					$1,144,800
	q	Off-Site Disposal of Non-Hazardous Soils (includes transportation & disposal)	i/	Ton	32,850	$65	$2,135,250
	r	Contingency (20% of Excavation and Disposal Costs)					$656,010
		Total Excavation and Off-Site Disposal Costs					$3,936,060
		Present Worth of Construction Costs (Year 1) (assumed to be disbursed in Year 1)	b/				**$3,678,600**

Table 6
Evaluation of Probable Costs for Excavation and Off-Site Disposal of Soils (Soil Alternative S2), Landia Site, Lakeland, Florida.

	Description	Notes	Unit	Qty	Unit Cost ($)	Total Cost
III. Construction Services						
1	Engineering/Construction Oversight (20% of subtotal excavation costs)	j/	ls	1	$229,000	$229,000
2	Construction Completion Report	k/	ls	1	$20,000	$20,000
3	Health and Safety Monitoring Instruments		ls	7	$1,500	$10,500
4	Project Management/Coordination	l/	ls	1	$15,000	$15,000
	Subtotal Construction Services Costs					$274,500
5	Contingency (20% of Construction Services Costs)					$54,900
	Total Construction Services Costs					$329,400
	Present Worth Construction Services Costs (Year 1) (assumed to be disbursed in Year 1)	b/				**$307,900**
	TOTAL PRESENT WORTH COSTS	c/				**$4,021,400**

Notes and Major Assumptions

a/ Project management and coordinating all project related activities.

b/ Present worth costs were estimated based on a net annual discount rate of 7%, assuming year-end distribution normalized to year-beginning.

c/ lump sum costs based on similar projects.

d/ Excavation of impacted shallow soils (0 to 2 ft bls) and subsurface soils (2 - 3 ft bls) that exceed Proposed Soil Cleanup Target Levels (SCTLs).

e/ Potentially unimpacted soils located above the subsurface impacted soils that exceed SCTLs.

f/ Load soils on trucks for transportation; handling of soils including transportation onsite and stockpiling.

g/ Assume construction equipment be decontaminated 25 times and use around 100 gals/decon; decon water disposed as non-hazardous waste.

h/ Assumed confirmation soil sampling at 50X50 grid (1 comp. Sample/grid) and 1 sample/50 ft of side wall; 1 soil sample/250 cy of soil to be hauled away including 20 percent for QA/QC samples for analysis of chlorinated pesticide only .

i/ Assumes soils to be non-hazardous and hauled away and disposed at Okeechobee facility (disposal facility for Yr. 2000 removal action).

j/ Labor and expenses to oversee and direct the excavation contractor and collecting confirmation soil samples; assumed to be 20% of the excavation cost.

k/ A removal action report will be submitted EPA.

l/ Project management and coordination during construction.

- Estimates are based information currently available and on assumptions listed in this report.
- Costs are based on vendor information, contractors' estimate, cost estimation manuals, and past experience.
- Abbreviations: ea = each; ls = lump sum; hr = hours; cy = cubic yards; lf = linear feet; Gal - gallons; wk = week; bls = below land surface.
- Total Costs are rounded to nearest $10 and the present worth costs are rounded to nearest $100.

Table 7
20-Year Evaluation of Probable Costs for Treatment Train using Chemical Oxidation, In-situ Bioremediation and MNA (Based on 2006 data), Landia Site, Lakeland, Florida.

	DESCRIPTION	NOTES	UNIT	QTY	UNIT COST ($)	TOTAL COST ($)
I. PredesignServices						
1	Project Management/Coordination	a/	ls	1	$13,300	$13,300
2	Chemical Oxidation Pilot Test	b/	ls	1	$100,000	$100,000
3	Pilot Test Work Plan/Permitting/Negotiation		ls	1	$10,000	$10,000
4	Pilot Test Report Preparation		ls	1	$10,000	$10,000
	Subtotal Presdesign Services Costs					$133,300
5	Contingency (20% of Predesign Services Costs)					$26,700
	Total Predesign Services Costs					$160,000
	Present Worth of Total Predesign Costs	c/				**$149,500**
	Payment Year 1					
II. Design Services						
1	Project Management/Coordination	a/	ls	1	$9,400	$9,400
2	Remedial Design Reports (30%, 90% & 100%)	d/	ls	1	$75,000	$75,000
3	Regulatory Meetings/Negotiations		ls	1	$10,000	$10,000
	Design Services Costs					$94,400
4	Contingency (20% of Design Services Costs)					$18,900
	Total Design Services Costs					$113,300
	Present Worth of Total Design Costs	c/				**$99,000**
	Payment Year 2					
III. Operation and Maintenance (O&M) Costs						
Year 1 O&M						
1	Chemical Oxidation					
	a Project Management/sub oversight/troubleshooting	a/	ls	1	$5,700	$5,700
	b Installation of 120 injection wells	e/	ea	120	$1,500	$180,000
	c IDW disposal (4 drums/well)		ea	480	$60	$28,800
	d Chemical Injection by Subcontractor	f/	ea	1	$1,000,000	$1,000,000
	e Injection oversight labor/expenses	g/	ea	3	$10,300	$30,900
	f Engineering Support/Data Review		ea	3	$6,700	$20,100
2	In-situ Bioremediation (Outside Source Area)	o/				
	Treating pesticides in outside of the ChemOX area		ls	1	$280,100	$330,100
	Treating pesticides north of the source area		ls	1	$377,800	$377,800
	Treating nitrates		ls	1	$460,700	$460,700
	(Includes groundwater effectiveness monitoring)					
	Subtotal Annual O&M and Monitoring Cost (Year 1)					$2,434,100
3	Contingency (20% of Annual O&M and Monitoring Costs)					$486,800
	Total Annual O&M and Monitoring Cost (Year 1)					$2,920,900
	Present Worth of Annual O&M and Monitoring (Year 1 O&M)	c/				**$2,551,200**
	Payment Year 2					

Table 7
20-Year Evaluation of Probable Costs for Treatment Train using Chemical Oxidation, In-situ Bioremediation and MNA (Based on 2006 data), Landia Site, Lakeland, Florida.

		DESCRIPTION	NOTES	UNIT	QTY	UNIT COST ($)	TOTAL COST ($)
Year 2 O&M							
4		In-situ Bioremediation (Source Area)					
	a	Project Management/sub oversight/troubleshooting	a/	ls	1	$13,700	$13,700
	b	Electron Donor Storage Tank (insulated, 5000 gal)/foundation		ls	1	$18,000	$18,000
	c	Portable mixing/injection system (trailer)		ls	1	$10,000	$10,000
	d	Misc. piping/instruments/valves/fittings		ls	1	$10,000	$10,000
	e	Start-up		ls	1	$10,000	$10,000
	f	Carbon Source	l/	gal	27,000	$2.0	$54,000
	g	Potable Water	m/	gal	2,430,000	$0.004	$9,720
	h	O&M labor	n/	hr	480	$75	$36,000
	i	Replacement Piping/Fittings/Miscellaneous Equipment		ls	1	$1,000	$1,000
	j	On-Site Vehicle (pickup truck) - Lease	h/	ea	12	$300	$3,600
	k	Project Expenses (gasoline/per diem)		ea	12	$250	$3,000
	l	Engineering Support/Data Review		ea	12	$1,340	$16,080
5		In-situ Bioremediation (Outside Source Area)	o/				
		Treating pesticides in outside of the ChemOX area		ls	1	$280,100	$330,100
		Treating pesticides north of the source area		ls	1	$377,800	$377,800
		(Includes groundwater effectiveness monitoring)					
		Subtotal Annual O&M and Monitoring Cost					$893,000
6		Contingency (20% of Annual O&M and Monitoring Costs)					$178,600
		Total Annual O&M and Monitoring Cost					$1,071,600
		Present Worth of Annual O&M and Monitoring (Year 2)	c/				**$874,700**
		Payment Years 3					
Year 3 O&M							
7		In-situ Bioremediation (Source Area)					
	a	Project Management/sub oversight/troubleshooting	a/	ls	1	$13,700	$13,700
	b	Electron Donor Storage Tank (insulated, 5000 gal)/foundation		ls	1	$18,000	$18,000
	c	Portable mixing/injection system (trailer)		ls	1	$10,000	$10,000
	d	Misc. piping/instruments/valves/fittings		ls	1	$10,000	$10,000
	e	Carbon Source	l/	gal	27,000	$2.0	$54,000
	f	Potable Water	m/	gal	2,430,000	$0.004	$9,720
	g	O&M labor	n/	hr	480	$75	$36,000
	h	Replacement Piping/Fittings/Miscellaneous Equipment		ls	1	$1,000	$1,000
	i	On-Site Vehicle (pickup truck) - Lease	h/	ea	12	$300	$3,600
	j	Project Expenses (gasoline/per diem)		ea	12	$250	$3,000
	k	Engineering Support/Data Review		ea	12	$1,340	$16,080
8		In-situ Bioremediation (Outside Source Area)	o/				
		Treating pesticides in outside of the ChemOX area		ls	1	$280,100	$330,100
		Treating pesticides north of the source area		ls	1	$377,800	$377,800
		(Includes groundwater effectiveness monitoring)					

Table 7
20-Year Evaluation of Probable Costs for Treatment Train using Chemical Oxidation, In-situ Bioremediation and MNA (Based on 2006 data), Landia Site, Lakeland, Florida.

	DESCRIPTION	NOTES	UNIT	QTY	UNIT COST ($)	TOTAL COST ($)
	Subtotal Annual O&M and Monitoring Cost					$883,000
9	Contingency (20% of Annual O&M and Monitoring Costs)					$176,600
	Total Annual O&M and Monitoring Cost					$1,059,600
	Present Worth of Annual O&M and Monitoring (Year 3)	c/				**$808,400**
	Payment Years 4					
	TOTAL PRESENT WORTH COSTS	c/ p/				**$4,482,800**

Notes:
- a/ Project management and coordinating all project related activities.
- b/ Assumes installation of 10 2" PVC injection points to a depth of 30 feet and three events using Modified Fenton's Reagent.
- c/ Present worth based on a rate of 7%, assuming year-end distribution normalized to year-beginning.
- d/ Assumes Remedial Action Plan, Work Plan, and Interim Reports will be submitted.
- e/ Assumes installation of 120 2" PVC wells to a depth of 30 feet.
- f/ Assume two depths per event at 120 locations using Modified Fenton's Reagent. LANDIA = three events; FFF = three events
- g/ Assume 30 hours of O&M per event performed by non-technical (unskilled) / trained laborers.
- h/ Assumes $300 per week rental per vehicle.
- i/ Assumes sampling of 28 wells per event plus 5 QA/QC: cost includes labor
- j/ Assumes 20 wells per event plus 2 QA/QC.
- k/ Assumes equipment rental and expenses for sampling.
- l/ Assumes 10 gallons of carbon source (assumes molasses for pricing) per well per event.
- m/ Assumes 90 gallons of water per well per event.
- n/ Assumes 40 hours of O&M per event performed by non-technical (unskilled) /trained laborers.
- o/ Includes injection points, carbon source, equipment, and semi-annual monitoring
- p/ Assumes 3-years of implementation of groundwater interim action will coincide with the 5-year review for the soil remedial action.
- Costs are based on vendor information, contractors' estimate, cost estimation manuals, and past experience.
- Abbreviations: ea = each; ls = lump sum; hr = hours; CY = cubic yards; LF = linear feet; Gal - gallons; wk = week;

12.4 Expected Outcomes of the Selected Remedy

The purpose of this response action is to protect human health and the environment by addressing the risk associated with human exposure to contaminated soil and groundwater at the Site. The soil at the Site will be restored to the more stringent of the direct exposure levels or the site-specific leachability levels. The direct exposure level will be based on industrial or residential use as appropriate for the location. Implementation of the interim groundwater action is expected to significantly reduce the highest groundwater contaminant concentrations and have a beneficial impact on those areas of lower contaminant concentrations. Table 5 presents the final cleanup goals for the soil and groundwater.

The Site is currently available for industrial/ commercial use and it is anticipated that these activities will not be restricted during the implementation of the selected remedies. Institutional controls consisting of restrictive covenants and current groundwater use restrictions will ensure future protectiveness until the cleanup goals are attained. A statutory review (5-year review) will be conducted every five years to evaluate and assess the effectiveness of the remedy.

The selected soil remedy will remove most of the contaminated soil above the cleanup goals (except soils left under building footings/foundations). The excavation and disposal will restore the soils to below the remedial goals within a year. The effectiveness of the interim groundwater action will be evaluated in the first five year review and it is anticipated that a final action to all address groundwater contamination will be selected after this evaluation.

13.0 Statutory Determinations

Under CERCLA §121 and the NCP, the lead agency must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (ARARs)(unless a statutory waiver is justified), are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the Selected Remedies meet these statutory requirements.

13.1 Protection of Human Health and the Environment

The selected remedies will protect human health by eliminating or controlling risks associated with human exposure to contaminated soil and groundwater at the Landia Site and surrounding areas. Soil that is impacted with COC concentrations above direct exposure and site-specific leaching criteria will be removed from the Site. Institutional controls will be implemented to retain the industrial/commercial use of the Site and prevent exposure to soils above SCTLs remaining under building footings. Groundwater will be actively treated to reduce COC concentrations. Institutional controls will be implemented to restrict the use of contaminated groundwater. The selected remedy for soil is expected to reduce contaminant concentrations to the remedial goals within approximately one year. The timeframe to reach groundwater cleanup goals will be evaluated in the final ROD that will be prepared in the future to address remaining groundwater contamination.

13.2 Compliance with ARARs

The selected remedies will be designed to comply with all of the applicable or relevant and appropriate provisions of the statutes, rules, regulations and requirements presented in Table 8.

13.3 Cost Effectiveness

In EPA's judgment, the selected remedies are cost effective and represent a reasonable value for the money to be spent. The following definition was used in making this determination: "A remedy shall be cost effective if its costs are proportional to its overall effectiveness." (40 CFR §300.430(f)(1)(ii)(D)). This was accomplished by evaluating the "overall effectiveness" of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and compliant with ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination: long-term effectiveness and permanence, reduction in toxicity, mobility, and volume through treatment, and short-term effectiveness. The relationship of the overall effectiveness of these remedial alternatives was determined to be proportional to the costs and hence represent a reasonable value for the money to be spent.

Soil Alternative S2, the selected alternative, costs less than the other soil alternative to implement. Alternative S2 provides more of a reduction in toxicity, mobility, and volume by removing a majority of the soil impacted above the cleanup goals (except for some impacted soils remaining under building footings/foundations). Alternative S2 provides a long-term effectiveness and permanence and less maintenance than Alternative S3. Alternatives S2 and S3 provide short-term effectiveness; however, with Alternative S3, some impacted soil would remain on-site beneath an engineered cap requiring long-term maintenance and institutional controls.

Table 8 – ARARs for Selected Remedy					
Medium	**Requirement**	**Citation**	**Status**	**Description**	**Action to Attain Requirement**
	Federal				
Ground Water	Safe Drinking Water Act: National Primary Drinking Water Standards	40 CFR 141	Applicable to potential drinking water sources.	Establishes health-based standards for public water systems (maximum contaminant level goals (MCLGs) and maximum contaminant levels (MCLs).	Protecting water supplies through institutional controls.
Soil	Resource Conservation and Recovery Act (RCRA)	40 CFR 268	Applicable to off-site treatment of impacted soils.	Establishes treatment standards based on best demonstrated available technology for treatment of hazardous wastes.	Disposing of wastes at a properly licensed landfill.
Soil	RCRA Toxicity Characteristic Rule	40 CFR 261	Applicable to characterizing soils exceeding TCLP criteria.	Establishes levels of chemicals which would harm human health or the environment if the waste was mismanaged.	
Soil	Clean Air Act: National Primary and Secondary Ambient Air Quality Standards (NAAQS)	40 CFR 50	Relevant and appropriate during a remedial action (e.g., soil excavation).	Establishes standards for ambient air quality to protect public health and welfare.	Implementing best management practices during excavation (i.e., dust control).
Soil	National Emissions Standards for Hazardous Air Pollutants (NESHAPs)	40 CFR Part 61	Relevant and appropriate during a remedial action (e.g., soil excavation).	Provides emissions standards for hazardous air pollutants for which no ambient air quality standards exist. These requirements address the excavation, handling, and treatment of contaminated soil at the site.	Implementing best management practices during excavation (i.e., dust control).
Soil and surface water	Federal Water Pollution Control Act: USEPA Ambient Water Quality Criteria (AWQC)	33 USC A26; 40 CFR 131	Relevant and appropriate when modified to reflect the designated or potential use of the affected waters, the media affected, and the purpose of the criteria.	Objectives are to restore and maintain the chemical, physical, and biological integrity of the nation's waters.	Best management practices will be implemented for erosion and sediment control during the excavation.
Soil and Ground water	Construction Standards	29 CFR 1929	Applicable.	Establishes occupational safety and health standards for the construction industry	All proposed site activities will provide an adequate level of worker protection.

Medium	Requirement	Citation	Status	Description	Action to Attain Requirement
Soil and Ground water	Occupational Safety and Health Administration Regulations	29 CFR Parts 1904, 1910, and 1926	Applicable.	Occupational safety and health requirements applicable to workers engaged in onsite work during implementation of remedial actions	All proposed site activities will provide an adequate level of worker protection.
Soil and Ground water	Hazardous Waste Operations and Emergency Response	29 CFR 1910	Applicable.	Defines health and safety procedures necessary during remedial investigations and cleanup	All proposed site activities will provide an adequate level of worker protection.
Soil	Identification and listing of hazardous waste	40 CFR 261 et. seq.)	Applicable if hazardous wastes are generated on site as a result of cleanup activities.	Defines those solid wastes that are subject to regulation as hazardous wastes under 40 CFR 262-265, and 124, 127, and 271	
Soil	Standards applicable to generators of hazardous waste	40 CFR 262	Applicable if remedial action involves generation of hazardous waste.	Establishes standards for generators of hazardous waste that address waste accumulation, preparation for shipment and completion of the uniform hazardous waste manifest.	
Soil	Land Disposal Restrictions	40 CFR 268	Land disposal treatment requirements are applicable for disposal of hazardous waste/soils at a disposal facility.	Prohibits land disposal of specified untreated hazardous wastes and provides special requirements for handling such wastes.	
Soil	Hazardous Materials Transportation Act; Hazardous Material Transportation Regulations	44 USC 1801-1813; 40 CFR 107-171-177	Applicable for offsite transportation of hazardous materials/soils.	Regulates transportation of hazardous materials	
Soil	DOT Rules for Hazardous Materials Transport	49 CFR Parts 107, 171-179	Applicable if offsite shipment of hazardous wastes/ materials/ soils occurs.	Regulates the transport of hazardous materials	
Ground water	Underground Injection Control Regulations (UIC)	40 CFR 144	Applicable to injection wells used for remedial actions.	Regulates underground injection of waste and other industrial fluids	

Medium	Requirement	Citation	Status	Description	Action to Attain Requirement
	State				
Soil and Ground water	Contaminated Site Cleanup Criteria	Florida Statute Chapter 376	Applicable	Requires cleanups in the State of Florida to reduce the excess lifetime cancer risk to 1 X 10^{-6} for carcinogens and a hazard index of 1 or less for noncarcinogens.	
Ground water	FDEP Drinking Water Standards	F.A.C. Chapter 62-550	Applicable.	Establishes MCLs for contaminants in public water systems	Protecting water supplies through institutional controls.
Soil	Florida Surface Water Quality Standards	F.A.C. Chapter 62-302	Applicable.	Establishes standards of quality for all surface waters in the state. Also, allows for site-specific alternative criteria for water bodies that may not meet a particular ambient water quality criterion applicable to the classification of the water body due	Best management practices will be implemented for erosion and sediment control during the excavation.
Ground water	Regulation of Wells	Chapter 40D-3	Applicable for construction of monitoring wells	Southwest Florida Water Management District (SWFWMD) rules govern the construction of water wells.	
Soil	Air Pollution Control - General Provision	F.A.C. Chapter 62-204	Relevant and appropriate during a remedial action (e.g., soil excavation).	Establishes maximum allowable levels of pollutants in the ambient air, or ambient air quality standards, necessary to protect human health and public welfare.	Implementing best management practices during excavation (i.e., dust control).
Soil	Florida Hazardous Waste Rule	F.A.C. Chapter 62-730	Applicable if remedial action involves generation of hazardous waste.	Adopts by reference sections of 40 CFR concerning generation, storage, treatment, transportation and disposal of hazardous waste.	
	Regulations of Stormwater Discharge	F.A.C. Chapter 62-25	Applicable for new stormwater discharge facilities.	Regulates the discharge of untreated stormwater which may be expected to be a source of pollution of waters of the state.	
Soil	Solid Waste Management Facilities	F.A.C. Chapter 62-701	Applicable for remedial actions involving solid waste management.	Establishes standard for construction and operation & closure of solid waste management facilities to minimize threats to public health and the environment.	

Medium	Requirement	Citation	Status	Description	Action to Attain Requirement
Ground water	Underground Injection Control	F.A.C. Chapter 62-528	Applicable to injection wells used for remedial actions.	Establishes the State UIC program that is appropriate to the hydrogeology of Florida & is consistent with the requirements of Federal UIC Program.	
Soil and Ground water	Florida Well Head Protection	F.A.C. Chapter 62-521	Applicable to remedial actions in the well head protection areas.	The intent is to protect potable water wells from contamination.	

The interim action for groundwater is expected to significantly lower contaminant concentrations in the treatment area and have a beneficial impact on the residual groundwater contamination. Collection of regular groundwater data will not only evaluate the effectiveness of the interim action but will also provide critical data to select a final groundwater remedy.

13.4 Use of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected alternative for soil makes use of permanent solution to restore the soil and to below cleanup goals found in Table 5 and to levels protective of human health. The treatment alternative (S3) would provide an equal amount of permanence as the selected remedies, but is not cost effective because of the longer duration and maintenance required to achieve cleanup goals. The selected soil remedy's comparative advantage over the other soil alternatives is that the majority of the soil impacted above ARARs will be removed from the Site thus allowing for relatively unrestricted industrial use (except for some impacted soil remaining under building footings/foundations). The selected soil remedy does not use alternative treatment technologies as the preferred soil remedy because the volume of soils to be remediated is too small for such technologies to be economically viable. The remedy includes excavation and off-site disposal which is consistent with previous removal actions, and provides a permanent solution.

The interim groundwater remedy will use chemical oxidation in areas with elevated levels of pesticide groundwater contamination and in-situ bioremediation to reduce the toxicity, mobility and volume of COCs. The interim action will result in a lower residual risk, a greater reduction in toxicity and volume of COCs (with active chemical oxidation and in-situ bioremediation of areas with elevated levels of pesticide groundwater contamination) and greater effectiveness over the long-term period.

13.5 Preference for Treatment as a Principal Element

The selected soil remedy does not use treatment due to the relatively low contaminant levels of the soil to be remediated. Most principal threat wastes that were at the Site were removed during the previous removal actions. Only isolated areas of principal threat waste remain which, during the previous removal actions, were covered with two feet of fill to prevent exposures. Due to the relatively small volumes of principal threat wastes remaining, the remedial technologies considered were consistent with the removal actions and included excavation and off-site disposal.

The interim groundwater remedy satisfies the preference for treatment. The remedy will include a treatment process using chemical oxidation in areas with elevated levels of pesticide groundwater contamination and in-situ bioremediation in other areas of the treatment zone, reducing the toxicity, mobility and volume of COCs.

13.6 Five-Year Review Requirements

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure and will take more than five years to attain remedial action objectives and cleanup levels, a statutory review would be conducted within five years of initiation of remedial action for the Site to ensure that the remedy is, or will be, protective of human health and the environment.

14.0 Documentation of Significant Changes

The Proposed Plan for the Landia Site was released for public comment in June 2007. The public comment period ran from June 25, 2007 – July 25, 2007. The Proposed Plan identified Soil Alternative S2, excavation and off-site disposal of soils, and an interim action for the treatment of groundwater using chemical oxidation and in-situ bioremediation in the most contaminated areas as the Preferred Alternatives for soil and groundwater remediation. EPA reviewed all written and verbal comments submitted during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate.

APPENDIX A

Responsiveness Summary

APPENDIX A

Responsiveness Summary
Landia Chemical Superfund Site
Lakeland, Florida

The public comment period on the draft Proposed Plan for the Landia Chemical site was held from June 25, 2007 through July 25, 2007. A public meeting was held at the Lakeland Center on July 10, 2007, at 7:00 pm. The comments received during the public comment period are summarized below. This Responsiveness Summary addresses the comments received during the public comment period.

1. When will the Remedial Action begin?

   EPA Response: After signature of the Record of Decision (ROD), EPA will negotiate with the Potentially Responsible Parties (PRPs) the terms under which the ROD will be implemented. After negotiations are complete, the design of the remedy will be conducted and then the remedy will be implemented. The soil excavation portion of the remedy will be conducted prior to implementation of the interim action for groundwater. The soil excavation is estimated to begin either the summer or fall of 2008.

2. Is the drinking water near the Site currently poisonous to the area residents?

   EPA Response: No. Residents in the area near the Site are supplied municipal drinking water from the City of Lakeland which is pumped from deep wellfields, treated at the water treatment plant and regularly sampled. The nearest municipal well is more than a mile from the Site in the opposite direction of groundwater flow.

3. Which streets have the greatest concentrations of pesticides in the groundwater beneath them?

   EPA Response: The groundwater from the Site flows to the north, west, and south. Generally speaking, contaminant concentrations are greatest on the Site property and decrease as groundwater moves away from the Site.

4. Is Lake Bonnet affected from the Site?

   EPA Response: No. Current groundwater monitoring data indicate contamination has not migrated to Lake Bonnet. Groundwater monitoring will continue in order to ensure the extent of contamination is known.

5. What are the health effects that have been found?

   EPA Response: The Florida Department of Health has conducted numerous health studies in the area including a Fish Tissue study from the Highland Street Pond in March 2000, a Public Health Assessment (June 27, 2000), an Exposure Investigation investigating the public health implications from eating pole beans and pinto beans grown from a garden on Wayman Street (August 10, 2000), and a study of selected cancer rates. While it is difficult to determine health effects from past exposures due to lack of analytical data, the studies did find that there was no apparent public health hazard for nearby residents.

6. Are the pipes that carry water to the neighborhood in contaminated soil? If so, and the pipes were to break, would contamination get into the drinking water?

   EPA Response: Soil sampling shows very limited, if any contamination in the areas where water supply piping would be found. If pipes were to rupture in an area with soil contamination, it is very unlikely that any contamination would get into the drinking water. After broken pipes are repaired, water lines are flushed at the next hydrant to flush out any soil that may be in the pipes. It is important to note that all identified off-site soil contaminants are well below acute levels and are only present at low concentrations that are unacceptable only over long periods of time with consistent exposure.

7. There was a lawsuit in the past involving residents in the area. A lot of the residents didn't get paid. Is that going to take place again?

   EPA Response: EPA has no authority or involvement in civil lawsuits between residents and private companies.

8. Is this the only area in Lakeland that is contaminated?

   EPA Response: This is the only National Priorities List or "Superfund" site in Lakeland. However, there are other cleanup programs that address contaminated sites. EPA maintains a mapping and listing tool that shows sites where pollution is being or has been cleaned up throughout the United States called Cleanups in My Community. It maps, lists and provides cleanup progress profiles for sites, facilities and properties that have been contaminated by hazardous materials and are being, or have been, cleaned up under EPA's Superfund, RCRA and/or Brownfields cleanup programs.
   This tool is available on the Internet at http://www.epa.gov/enviro/cleanups/

9. What was the cutoff point when EPA stopped sampling?

   EPA Response: The purpose of the Remedial Investigation was to determine the nature and extent of contamination in the soil, groundwater, sediment, and surface water. In order to accomplish this, screening criteria were used as a basis for deciding how far to sample. Samples were compared to the screening criteria which were generally the most stringent of all available, health based criteria (state and federal). Sampling occurred until detected concentrations were lower than the screening criteria. More specific information on screening criteria can be found in Section 7.1.1 Chemicals of Concern.

10. The Site should be returned to the same commercial state that it was when the cleanup was started. This means there should be proper drainage and the paved areas be replaced. The absence of someone on the property regularly encourages trespassing and vandalism.

    EPA Response: EPA's primary responsibility is protection of human health and the environment. However, EPA encourages the reuse of contaminated properties and takes future use into consideration when designing and implementing a remedy. EPA agrees that it is beneficial to have someone regularly occupy the property. It is EPA's intent to require that any disturbed areas be restored to their previous conditions. It may be beneficial to replace the impermeable surfaces to minimize infiltration of rainwater which may slow groundwater contaminant migration. This will be further evaluated and decided during the remedial design. EPA cannot require enhancements to the property unless it is to meet an ARAR that is triggered by implementation of the remedy.